THE

AUSTRALIAN

ZOOLOGIST

Volume 17, Part 1
March, 1972

Scientific Journal of

The Royal Zoological Society of New South Wales

Price $2.50

NOTICE TO AUTHORS

Papers will be considered for publication in *The Australian Zoologist* if they make an original contribution to whole animal biology of the Australian fauna. Papers submitted will be subjected to review and thence to the normal editorial process, in the course of which authors will receive edited galley proofs for correction. A manuscript is accepted on the understanding that it is to be published exclusively in *The Australian Zoologist.*

MANUSCRIPTS (original and one copy) should be sent to the Editor, "The Australian Zoologist", School of Biological Sciences, Macquarie University, North Ryde, N.S.W. 2113. They should be typewritten (double spaced) on good quality paper. All pages of the manuscript must be numbered consecutively, including those containing references, tables and figure legends, which should all be placed after the text.

On the first page of the manuscript should appear the title of the paper, name of the author, the name of the Institution where the work was done and the present postal address if different from that of the Institution. Titles should be as brief, but as informative, as possible. A short title, to serve as a running head and consisting of not more than 50 letters (including spaces) must also be given on the title page.

The abstract (up to 200 words) should state concisely the scope of the work and the principal findings and should be suitable for direct use by abstracting journals. The section headings should be Introduction, Materials and Methods, Results, Discussion, Acknowledgements and References. Presentation must be clear and concise and all unnecessary repetition especially in consecutive sections should be avoided. Footnotes should be avoided.

REFERENCES are cited in the text by the author and date and are not numbered. Authors are referred to recent issues of *The Australian Zoologist* for the style used. No editorial responsibility can be taken for the accuracy of the references; authors are requested to check these with special care. Abbreviations of titles of periodicals should conform to those used in *World List of Scientific Periodicals,* 4th Edition.

TABLES should be numbered with arabic numerals, be accompanied by a title and be typed on separate sheets. Their approximate position in the text should be indicated by a note in the margin.

ILLUSTRATIONS AND DIAGRAMS should be larger than the size of the finished block. Drawings must not exceed 30 x 20 cm. If the originals exceed this they should be photographically reduced and good quality prints provided. Half tone prints should be arranged as plates and mounted on stiff white board up to a maximum size of 30 x 20 cm. Authors will be allowed up to two Plates free of charge, but will be expected to pay the cost of any additional plates.

THE AUSTRALIAN ZOOLOGIST

VOL. 17 PART 1

THE DISTRIBUTION OF TERRESTRIAL AND FRESHWATER BIRDS ON LORD HOWE ISLAND, IN COMPARISON WITH NORFOLK ISLAND

by H. J. de S. DISNEY and C. N. SMITHERS
The Australian Museum, Sydney.

INTRODUCTION

Lord Howe Island was settled in 1834, 46 years after its discovery in 1788, and is of considerable interest to zoogeographers; the conservation of its native fauna and flora is a matter of considerable scientific importance.

We visited the island from 18th-30th November, 1969, during which time observations were made on the present distribution of terrestrial and freshwater birds in relation to the habitats available to them.

VEGETATION

Oliver (1917) has given an account of the plant formations and associations of the island from a botanical viewpoint.

"The classification of plant communities as bird habitats does not always coincide with the communities which would be defined by a plant ecologist; in many cases, general physiognomy is a more important factor in determining the suitability of an area as a bird habitation than the species of plants present. Also, it is sometimes necessary to distinguish areas as habitats for birds which would be meaningless to a student of natural plant associations e.g. urban environments" (Smithers and Disney, 1969). This is true of Lord Howe Island, although with modification the formations of Oliver (loc. cit.) can be used as a practical basis.

The following formations can be considered to have been available to birds as habitats when the island was settled by man.

ORIGINAL HABITATS

1. Temperate evergreen rainforest
   (a) Lowland tall forest
   (b) Lowland low forest
   (c) Mountain forest (low)
2. Palm associations
3. Moss forest
4. Scrub
   (a) Coastal scrub
   (b) Hill scrub
5. Rocky shores
6. Sand dunes
7. Beach
8. Marsh
9. Streams
10. Ponds

Temperate Evergreen Rainforest

Oliver (1917, p. 102) describes several distinct associations of this forest. They differ in component species, the degree of liane development and in height but offer a generally similar physiognomy. The differences can

be correlated with height, exposure and soil type. Much of the island was originally covered by one or other of the temperate evergreen forest associations. The tall forest associations occurred in the southern areas up to a height of about 300 metres, above which a low forest occurred, merging into the moss forest on the mountain summits. On the northern hills a lowland low forest occurred.

(a) The *lowland tall forest* included undergrowth, although not dense, of young palms and trees and there was a low growth of seedlings of trees and ferns. Lianes were present "their numerous rope-like stems forming regular entanglements" (Oliver, 1917, p. 102).

(b) The *lowland low forests* which covered the northern hills were similar to those of the taller forest, but the upper storeys were lower.

(c) *Mountain low forest* occurred on the slopes of the southern mountains above about 300 metres. The lianes were fewer than at lower altitudes and the canopy not as high as that on the lower slopes. Much of the area on which this association occurred is devoid of soil, the trees growing amongst stones, rocks and boulders. Ground cover, under these circumstances, as can be expected, is minimal.

Palm association

Palms occurred scattered naturally through the forest formations and form a natural element of the forest, the species varying from one association to another. There were, however, areas in which palms occurred in pure stands naturally. Few plant species other than palms grew in these groves the nature of the palm growth and fallen palm leaves giving these areas a particular character.

Moss forest

The plateau at the summit of Mount Gower was covered with a unique moss forest. This is the locality from which many of Lord Howe Island's endemic invertebrate species have been collected and described. Zoologically and botanically it is truly unique. Oliver (1917, pp. 106-108) has described this formation and mentioned undergrowth and floor mosses and plant growth of a luxuriance not found at lower altitudes. The undergrowth was described as often extremely dense and almost impenetrable, especially on exposed places.

Scrub

Low scrub, consisting mainly of thickets of woody plants, occurred in some areas. This formation was found mainly along the coast and in other exposed situations where sea winds are prevalent e.g. along cliff tops and exposed ridges.

Rocky shores, Sand Dunes and Beach

These habitats do not require any comment.

Marsh

There were a few small areas of marshy or boggy land where small streams over-ran their banks on flat land.

Streams and Ponds

There were many streams on the island; areas of open standing water were few and small.

SECONDARY HABITATS

It is clear from early accounts of the island and even from that of Oliver (loc. cit.) that changes have taken place and are still taking place in the vegetation structure and composition and that the habitats now available are not in the same condition as those present on the arrival of man. The degree of change is not easy to determine in many cases, although in some areas has been so gross as to be obvious e.g. where pastures now replace forest. It is extremely doubtful whether any area of the island has remained completely

unchanged since human occupation and in this sense all the present habitats can be considered as being secondary to some degree. The main causes of alteration to the environment have been the activities of man, rats, pigs and goats.

The present bird habitats coincide with those listed as original plant associations above and to these can now be added the Pasture and Urban Habitats.

The Lowland tall forest

This now has an appearance different from that described by Oliver (1917, p. 104). There is very little undergrowth and the entanglements of lianes are uncommon. Seedlings of forest trees are few and it is clear that the death of the upper storey plants, in due course, with so little regeneration, will cause a major change to the forest environment. It is interesting to note that on Transit Hill the amount of undergrowth and seedling regeneration is considerably greater than on the lower eastern slopes of the southern mountains. This is undoubtedly due to the fact that pigs and goats are not permitted to remain for long in the Transit Hill area but are soon detected and shot out; also, a rat eradication campaign is being very intensively pursued in the northern half of the island and has resulted in considerable reduction in rat populations. In general terms it can be said that the temperate forest areas are now much thinner and more open in the lower and ground storeys and certainly would afford less bird cover in consequence.

Lowland Low Forest

This has been altered in a similar way; in most places there is virtually no ground cover nor is there much indication of regeneration. For example, lianes were common but are hardly in evidence now. It is now possible to see through the forest for long distances at heights below a few feet. The lower storeys have largely disappeared in many areas.

Mountain Low Forest

The nature of the soils on which this type is found make it unlikely that dense undergrowth could grow. This type is probably the least altered of the forest habitats; also, we were informed by residents that goats and pigs are less often seen in these areas. This is probably due to lack of ready food supply; pigs would find it hard to grub up in this area and there is little low growth on which goats could browse. The vegetation is here eaten off to a height which goats can conveniently reach.

Palm Association

This association is, by nature of its dominant plant, a clearly defined habitat. The pecularities of the association are reinforced, in those areas in which the palms are definitely cultivated, by virtue of weeding practices and such general care of the plants as removal of dead fronds.

Moss Forest

This unique forest type, so important scientifically and so small in area (a few hundred acres at most) has clearly been altered considerably in the last 60 years. The luxuriance of the lower storey is so much reduced that, in capturing woodhens for marking, it was found very easy to move through this area wielding a long-handled net without hindrance. The amount of undergrowth has clearly been reduced by the activities of pigs, goats and rats. The rat extermination programme, understandably, is less intense on the southern mountains than other areas of the island.

Scrub Areas

The scrub areas have been invaded extensively by goats and the ground storey almost cleared in some areas. It is possible to kneel down in some scrub areas and have a long, unimpeded view between the bushes at low levels. Regeneration and undergrowth are being reduced to a minimum.

Marshes

These occur in small areas, either in open pasture or where there is still some forest cover overhead.

Streams and ponds

These are found in covered as well as open habitats; they vary in extent depending on rainfall but all ponds are relatively small.

Pasture

Clearing of forest and scrub has resulted in pasture formation, of which there are quite extensive areas in the northern half of the island. These areas are usually well cared for and weed encroachment held in check in most cases although weeds which find this type of environment suitable for colonizing in case of neglect are present on the island e.g. lantana. Some pasture areas are on exposed land adjacent to the coast; others away from the coast are in more protected situations.

Urban areas

The "urban", more closely settled areas are largely confined to the northern parts of the island although isolated gardens occur nearer the major forested areas further south. In all areas, the gardens remain well stocked with native plants, either as remnants of the original forest or as planted specimens. The roads are usually lined with remnants of native forest which form a reticulation of native vegetation through much of the settled area. The importance of this and the garden trees is great in that they provide a continuous remnant of the initial forest and form corridors along which forest birds travel and in which they can maintain themselves.

BIRDS

White-faced Heron, *Ardea novae-hollandiae*

During our stay 3 were recorded on different days on the pastures of Old Settlement Beach and Moseley Park. This is where there is fresh water. One was also seen on the pasture behind "Pine Trees" Guest House. This species is a frequent visitor and up to 15 have been recorded in a flock (Nicholls, 1952). Occasionally they stay to breed and this happened in the summer of 1937-38 (Hindwood, 1940). As on Norfolk island they have also been seen feeding on the beach at low tide.

Black Duck, *Anas superciliosa*

This is a casual visitor. None was recorded by us. A pair nested along Moseley Creek in September, 1963 and 100 ducks were seen in October, 1956 but they gradually left and had all gone by April 1957 (McKean and Hindwood, 1965). In Norfolk they appear to be resident.

Californian Quail, *Lophortyx californica*

This was introduced in 1880 and fairly large flocks were observed until the advent of rats in 1918. This would indicate that, as on Norfolk Island, there was sufficient suitable habitat of open areas for this bird to maintain itself.

Eastern Swamphen, *Porphyrio melanotus*

This is a casual visitor and from our observations there is not any very suitable habitat for it except, perhaps, in Moseley Park Although it feeds in open pasture it seems to like to be able to retreat to fairly dense cover near water. These conditions are found by several of the streams in Norfolk Island and there it is a resident.

Lord Howe Island Woodhen, *Tricholimnas sylvestris*

This woodhen is endemic to Lord Howe Island and now apparently found only on the tops of the mountains; occasionally wandering birds are seen lower down. It is considered by us that the population is now very low. We spent two nights on the top of Mt. Gower and saw only 16 birds, of which we banded six. Each pair seems to have its own particular territory.

Norfolk Island has no similar rail. There is a related species in New Caledonia, but it has not been seen for many years, although one was possibly seen in 1936 (Delacour 1966). It would appear that many of the habits of the woodhen are similar to the New Zealand Weka or woodhens (*Gallirallus* spp.). The Lord Howe bird has a much longer and more slender bill. Unless the rats, pigs and goats are removed this rail will probably be soon extinct.

Golden Plover, *Pluvialis dominica*

These were found in the same habitats as on Norfolk Island. During our visit they could be found in ones or twos on small pasture fields either near the beach or, even, on a small field by the road to Ned's Beach. There was always one in the paddock behind "Pine Trees" Guest House at the bottom of Transit Hill. The largest number seen was 20 on Old Settlement Beach on 30th November when the creek was full and there were large pools from recent heavy rain.

Whimbrel, *Numenius phaeopus*

Unlike Norfolk Island, where so far the records are few, Whimbrel are regularly recorded. The greatest number so far recorded appears to be 30 (Hull, 1909). Our own observations on this species were similar to those for the Golden Plover. Three or four were seen on most of the bigger pastures and open areas, such as Middle Beach and Old Settlement Beach. The largest number seen was 10 in Moseley Park on 18th November. One was also seen in the same small paddock with the Golden Plover on Ned's Beach road. This compares with one seen by us at the same time of year on Norfolk Island in 1968 and four there in September, 1969 by Mr. Southwell (in litt.).

Eastern Curlew, *Numenius madagascariensis*

None was seen and this bird has rarely been recorded on Lord Howe Island but it is regularly seen on Norfolk Island.

Turnstone, *Arenaria interpres*

Flocks from 3 to 25 birds were seen on pasture at Moseley Park and Old Settlement Beach and they were also seen in pasture on the seaward side of Lagoon Road. None was seen feeding on the beach but little time was spent making observations on the beach.

Greenshank, *Tringa nebularia*

One was seen on the rough pasture at Moseley Park on 18th November, 1969.

Black-tailed Godwit, *Limosa limosa*

One was seen at Moseley Park on 18th November, 1969 and also present were 10 Whimbrel and two Golden Plover. The first record for this Godwit on Lord Howe Island was exactly five years before when Mr. J. D. Gibson saw one at Old Settlement Beach on 19th November, 1964 (McKean and Hindwood, 1965).

Bar-tailed Godwit, *Limosa lapponica*

Two were seen on Old Settlement Beach on pasture on 9th November and when disturbed they flew over to the beach.

Japanese Snipe, *Gallinago hardwickii*

This has been recorded several times on Lord Howe Island (McKean and Hindwood, 1965) and two were seen by us on Norfolk Island in the swamp below the Melanesian Mission in March, 1969.

Waders

We did not make special searches along the beaches for feeding waders and the only suitable wader habitats away from the beaches are by the pools and creeks at Old Settlement Beach and Moseley Park. From previous records of waders seen on Lord Howe Island any of the migrating waders which visit the east coast of Australia can be expected to be seen. Mr. Southwell, on Norfolk Island, is beginning to find the same for that island; he is the first ornithologist resident on the island to keep continuous records since the late Roy Bell.

White Tern, *Gygis alba*

Ten were seen over "Pine Trees" early in the morning of 19th November, 1969. White terns first came to the island during the war (1943) when an avenue of Norfolk Pines was cut down to make the airstrip on Norfolk Island (Mr. Dignam, pers. comm.). Nicholls (1952) also recorded their arrival and mentioned that they had increased to 50 by March 1946, but by the end of 1950 they had all gone. They are now known to breed on the island. Mr. Dignam (pers. comm.) suggests that the introduced Tasmanian Masked Owl finds it less trouble to catch the obvious white roosting birds at night rather than rats and he has found the remains of as many as 16 birds under some trees. The first nestling was seen in 1967/68 season by Master Dean Retmock, in a tree. In January, 1969 he found the first egg and showed it to Mr. Alan Rogers from Sydney. This nest was later photographed by Mr. Norman Chaffer. The egg was laid in a close horizontal fork of a Grey Bark, *Hemicyclia australasica* (Chaffer, pers. comm.).

Green-winged Pigeon, *Chalcophaps chrysochlora*

No Green Pigeons were seen or heard on the mountains in the true forest at the southern end of the island, but they were frequently seen (as Hindwood found in 1936) on the paths in the settled areas and were very tame. One was found in the evergreen forest on Transit Hill behind "Pine Trees" and another feeding under the palms at the bottom of the hill at the north end of Old Settlement Beach. It was not recorded in the literature until Hill mentioned it in 1869 (cf. Hindwood, 1940). Perhaps it does not like heavy thick bush but prefers fairly tall trees giving shade through which it can readily fly with the ground underneath open, as it feeds on the ground. Not until 1869 were conditions with paths and open tracks sufficient for it to feed along these tracks and the edges of pasture. The forest on Norfolk Island is more modified and open, with large trees such as White Oaks (*Lagunaria patersonia*) giving shade, under which the pigeons feed.

Crimson Rosella, *Platycercus elegans*

In contrast to its great abundance on Norflok Island, the birds released from the beached S.S. Makambo in 1918 did not succeed in establishing themselves on Lord Howe Island (Hindwood, 1940). The reason for this is not clear; there does not seem any reason why they did not breed unless there were no suitable hollows or there were no true pairs. They may have perhaps rapidly suffered the same fate as the indigenous parrot and been shot as potential pests of the islanders' crops.

Lord Howe Island Green Parrot, *Cyanorhamphus novae-zelandiae subflavescens*

This parrot was destroyed within 36 years after the first settlement of the island by the islanders because of the damage it did to their crops. The last recorded pair was observed in 1869 (Hindwood, 1940 from Hill, 1870, p. 46). There are still a few pairs of the Norfolk Island race on that island. These parrots are races of the New Zealand Red Fronted Parrot, *Cyanoramphus novae-zelandiae.*

Nankeen Kestrel, *Falco cenchroides*

On 21st November at 11 a.m. a kestrel was seen to fly past "Pine Trees" Guest House. On 25th November a bird was seen on the saddle between Mt. Gower and Mt. Lidgbird at the top of Erskine Valley. A pair was also seen here in January, 1970, by Mr. Lyndsay Hyem (in litt.). Three were seen between 12-24th February, 1967 by Mr. Garry Sefton (in litt.). Hindwood and Cunningham (1950) previously have recorded this bird from Lord Howe Island. Here it would seem to be a frequent visitor or perhaps a resident. On Norfolk Island it may be only an infrequent visitor. One was seen on this island on 24th November, 1969 (Southwell, in litt.).

Tasmanian Masked Owl, *Tyto novae-hollandiae castanops*

No owls were seen or heard by us, but as mentioned above (see under White Tern) Mr. Dignam said these owls found the White Terns easy prey. Mr. Chaffer in 1969 took a photograph of White Terns killed by owls which showed the terns had been eaten by plucking in the usual owl manner and not

killed by cats. These owls were introduced between December 1922 and October 1930 (Hindwood, 1940). Mr. & Mrs. Beaglehole saw one in daylight on 18th September, 1963 (Hindwood and McKean, 1965). One was recently found and photographed by Master Dean Retmock (Mr. Alan Roger, pers. comm.).

Barn Owl, *Tyto alba*

One was seen in February, 1967 by Mr. Garry Sefton (in litt.). This species was introduced in October, 1923, but there have been few sightings or reports of the birds being heard since. Hindwood (1940) observed one in 1936. Calls of *Tyto* species have been heard at other times and McKean and party heard a bird in Erskine Valley and at Middle Beach in September 1963 (Hindwood and McKean, 1965).

Mr. George Southwell, in a letter from Norfolk Island in September 1969 informed us that the Barn Owl had been heard from February to August, and that Mr. Gostling had an excellent tape of the call, which had been heard over the last four years.

Boobook Owl, *Ninox novaeseelandiae*

Neither the endemic race *Ninox n. albaria* nor any of the introduced Australian races appear to have been recorded on Lord Howe Island in recent years, although Hindwood (1940) often heard their call at night. On Norfolk Island, although we have not heard the call, Mr. Southwell, in his letter of September, 1969 confirmed that its call is still heard.

Cuckoos, Cuculidae

None of the five cuckoo species recorded by Hindwood (1940) were seen by us.

Long-tailed Cuckoo, *Eudynamis taitensis*

This species is regularly reported from both Norfolk and Lord Howe Islands, presumably on passage to and from New Zealand where it breeds. In January 1967, Mr. Chaffer (in litt.) and in February, 1967, Mr. G. Sefton (in litt.) both recorded cuckoos which were almost certainly this species.

Shining Bronze Cuckoo, *Chalcites lucidus*

This cuckoo is also regularly recorded on both islands on migration to and from New Zealand. It has bred on Norfolk and apparently sometimes on Lord Howe, but has not been recorded breeding on this island since the Lord Howe Island Warbler, *Gerygone insularis* became extinct.

Spine-tailed Swift, *Hirundapus caudacutus*

This swift was recorded on Norfolk Island flying over the top of Mt. Pitt in November 1968 (Smithers and Disney, 1969). It has been recorded several times on Lord Howe Island. There are several records for New Zealand, where it occurred in large numbers in the summer of 1943 (McCaskill, 1943).

Lord Howe Island Sacred Kingfisher, *Halcyon sancta adamsi*

This race of Sacred Kingfisher is large, as are the Norfolk Island and New Zealand races. It is frequent near open areas, such as a small, rough, paddock on Middle Beach road, where a bird was seen to take an insect on the wing from the top of a flowering weed. Another was seen to swoop down onto the ground to catch a long green caterpillar (?). It was not seen in the thick natural forest. The earliest collectors did not record it and it was first recorded by Hill in 1869 (Hindwood, 1940). It would thus seem that like the Green-winged Pigeon it did not appear until clearing by the islanders had provided a suitable habitat.

Welcome Swallow, *Hirundo neoxena*

Frequently one or more is seen on Lord Howe Island. One was seen by us near the jetty on 19th November, 1969. On Norfolk Island about twelve were seen by us on the top of Mt. Pitt in March, 1969. These were mainly young birds. Smithers again saw swallows present in the same place in June, 1970. Swallows do not seem to have been previously reported on Norfolk.

Vinous tinted Blackbird, *Turdus poliocephalus vinitinctus*

This race of *T. poliocephalus* was still present when Bell visited the island in 1913 although not in great numbers and quickly disappeared after the rats arrived in 1918 (Hindwood, 1940). Mr. Phil Dignam informed us that the "Doctor bird", so named after Dr. Foulis, who wore a long brown coat, (cf. Nicholls, 1952), nested in the fallen palm fronds at the base of the palms, and was readily taken by rats, which also eat the green dates. The nominate race on Norfolk Island is still present in small numbers in the Mt. Pitt forest reserve.

European Blackbird, *Turdus merula*

There is little to add to the report of McKean and Hindwood (1965). Blackbirds were seen by us frequently in the settled northern end of the island and a male bird sang every evening from the top of a tree at "Pine Trees" during our stay. They were also seen in the forest on Transit Hill above "Pine Trees". McKean and Hindwood (1965) recorded them on the middle slopes of Mt. Gower in 1962. We did not see any when we climbed Mt. Gower in November, 1969, but Mr. Lyndsay Hyem (in litt.) observed them on the summit in January, 1970. They were first reported on the island in December 1953 by Nicholls and Cpt. McComish noted them on Norfolk Island in 1939 (McKean & Hindwood, 1965). It would appear that this species is self introduced on both islands, probably from New Zealand. With the apparent reduction of the rats in their preferred areas by the use of poison, they can be expected to increase on Lord Howe Island.

Song Thrush, *Turdus ericetorum*

Like the previous species this bird also seems to have been self introduced to both islands, probably from New Zealand. On Norfolk Island it arrived in 1913 (cf. Hindwood, 1940). It was first seen on Lord Howe Island in 1928 by Mr. Whiting (Sharland, 1929) but nesting was not confirmed until January 1955 by Mr. Nicholls (McKean and Hindwood, 1965). Several birds were seen by us in the settled areas and two in forest on Transit Hill.

Lord Howe Island Warbler, *Gerygone insularis*

This warbler was possibly made extinct by the rats but was still common in 1928 (Sharland 1929). The Norfolk Island species, *Gerygone modesta,* is successfully inhabiting a wide range of habitats both natural and those modified by man (Smithers & Disney, 1969).

Lord Howe Island Fantail, *Rhipidura cervina*

After the rats came, this species soon became extinct; by 1924 it was very scarce and could not be found in 1928 (Sharland, 1929). The Norfolk Island species, *Rhipidura fuliginosa pelzelni* is still very common in any habitat in which trees and shrubs are available (Smithers & Disney, 1969).

Lord Howe Island Whistler, *Pachycephala pectoralis contempta*

This whistler, as Hindwood (1940) recorded, is one of the few native birds which have survived the rat onslaught. It seems to prefer evergreen scrub 20-30 ft. high and was seen in this type of forest on the hills and top of Mt. Gower and also along roadsides in the settled areas where native bush had not been cut down. A juvenile, still with rufous on head and breast, was seen on Transit Hill with an adult male on 27th November, 1969. It would appear that the Norfolk Island Whistler, *Pachycephala xanthoprocta,* is now less frequently seen in gardens on that Island because the road verges have all been cleared of natural forest remnants along which the whistlers travel to enter gardens.

Lord Howe Island Silvereye, *Zosterops tephropleura*

We are in agreement with McKean (McKean and Hindwood, 1965) that the dominant silvereye is *Z. tephropleura,* although once or twice the birds seen appeared larger and almost the size of a sparrow. There has been no definite record of the Robust Silvereye, *Z. strenua,* since the rats reached the island in 1918. It is not clear why one species should survive and the other disappear when both are faced with the same alteration of habitat. The similarly large White-breasted Silvereye in Norfolk Island (*Zosterops albogularis*) is also now very

scarce and rarely seen (Smithers & Disney, 1969). It is also not clear what happened to the Eastern Silvereye, *Z. lateralis*, introduced in 1924 from New South Wales and from Norfolk Island in 1925, 1931, and circa 1936 (Hindwood, 1940). *Z. tephropleura* on Lord Howe Island was readily seen in the native bush and also in the gardens feeding in hibiscus plants.

House Sparrow, *Passer domesticus*

On Norfolk Island this is abundant in urban areas, but it is not present on Lord Howe Island.

Starling, *Sturnus vulgaris*

These were only seen in or near open paddocks and never in any numbers, the largest number being 12; most had probably paired off to breed at the time of our visit. It would appear from previous records that their numbers are remaining much the same. Neither on this island nor on Norfolk do they appear to have invaded the native forest.

Magpie-Lark, *Grallina cyanoleuca*

This was common in the settled areas and was seen on the pasture areas. Large numbers were seen from "Pine Trees" Guest house to Salmon Beach along Lagoon Road. Two pairs were seen in a small patch of native forest beside the road. One young bird which had recently left the nest was seen. There were two nests about 50 yards apart in Norfolk Pines near "Pine Trees" Guest house. The male bird was sitting on one nest when seen and the other nest was still being built. It would appear that with the successful campaign against rats in the settled areas the Magpie-Lark is increasing.

The Magpie-lark has not reached nor been introduced to Norfolk Island.

Lord Howe Island Currawong, *Strepera graculina crissalis*

This bird was only observed in ones or twos by us, both in the forest on the slopes of Mt. Gower and Lidgbird and in the settled area. They were tame and two in a Pandanus grove by Old Settlement Beach came very close, one with a piece of Pandanus fruit in its bill. Currawongs are not present on Norfolk Island.

COMPARISONS BETWEEN NORFOLK ISLAND AND LORD HOWE ISLAND

It would appear that the main differences in the present vegetational habitats on Norfolk and Lord Howe Islands result from the fact that on Norfolk there has been more extensive and greater direct clearing by man, followed by grazing by cattle which has prevented regeneration, whereas on Lord Howe, although the forest appears at first very similar to the original, it has been greatly affected by wild goats and pigs with almost the complete removal of lianes and vines. With shooting now not permitted the goats and pigs are present in large numbers, especially in the southern mountains.

Another striking and important habitat difference is that in the settled areas of Lord Howe the road verges retain original forest which forms a reticulation in which bird populations are maintained whereas on Norfolk Island the road verges in the settled areas are very largely cleared and the many more gardens are more open.

Also, in many parts of Norfolk Island, areas which were once cleared as pasture or which were used for crop production have been allowed to degenerate into lantana thickets of varying degree of density or into tangled wood thickets.

The area which has been cleared of forest on Lord Howe is relatively less than that which has been cleared on Norfolk and the units of cleared area are individually smaller and have not been allowed to become invaded by weed thickets.

The smaller species of passerines were nearly all common to both islands, although they had evolved recognizable subspecific populations. On Lord Howe Island it is clear that the arrival of rats in 1918 and their breeding up to plague proportions probably caused the extinction of several bird species, namely, the Vinous-tinted Blackbird, Fantail, Warbler, and the Robust Silvereye. Only the Whistler and Smaller Silvereye managed to survive. It would appear from Hull

(1909) and Bell (Diary MSS., 1913) that the Vinous-tinted Blackbird nested on the ground or low down in the fallen fronds on the Kentia palms and that the Robust Silvereye placed its nest among the masses of fibre clothing the under side of the crown of palms. Here they would be readily found by the rats which also ate the green palm seeds. The rats would also seem to have prevented success in the attempts to introduce the Eastern Silvereye; this species usually nests on a horizontal branch not more than 15 feet up in a shrub. The nesting site of the silvereye, *Z. tephropleura,* has not been recorded (and neither Hull nor Bell found a nest) but birds were seen by us in November, 1969 carrying material up at least 15 ft. into a dark evergreen tree growing on the lawn at "Pine Trees". It is possible that this silvereye nests where it is less likely to be found by rats. The rats, by eating the seeds of plants, will have combined with the goats and pigs in removing most of the low scrub suitable for nesting sites. It is certain that pigs, goats and cats have been present for over 100 years and they must have modified the forest understorey and prevented regeneration. Hill (1870), who visited the island in 1869, recorded that pigs, cats and goats appeared to be abundant. Oliver (1909) referring to goats on the Kermadec Islands states that they do allow a certain number of palm seedlings to grow up as they only browse on the young palms.

The Lord Howe Island Warbler's nest site has not been recorded so no suggestion can be given as to why it disappeared except that it, too, must have nested in a position readily accessible to the rats.

The Fantail apparently nested usually only 3-15 ft. from the ground on a horizontal branch and presumably was readily found by the rats.

On the evidence available it is not clear how the Lord Howe Island Whistler managed to survive. Hull (1909) describes the site of the nest found by him as being only 8 ft. up in a shrub thickly overgrown with lawyer-vines in a palm glen.

On Norfolk Island it seems likely that the first noticeable reduction of the native birds came when cat distemper occurred on the island in 1951. This disease reduced the cat population and allowed the rat population to increase to the extent that not even vegetables could be grown, as these were destroyed by the rats (pers. comm. P. Ralston). Cats were reintroduced and the rat population declined, but they are still numerous. This, however, took place in time to prevent complete destruction of native birds. This would help to explain why the Grey Headed Blackbird, *Turdus poliocephalus,* is now present only in small numbers. Also, the clearing of the road verges with increased cattle grazing removed the usual avenues by which the forest birds reached the gardens.

The presence of large rat populations could account for the disappearance, on both islands, of *Aplonis fuscus* (Island (Shining) Starlings). This species nested in tree holes, which the rats would be certain to investigate. Rats would also account for the disappearance of the Black and White Sparrow, *Lalage leucopygius* on Norfolk Island. Hull (1909) found two nests, both built in introduced pine trees near a residence .

FINAL COMMENTS

It seems that to retain the indigenous birds on these two islands the rats must first be destroyed and then the wild cats removed in order to protect the sea birds. Ratsak or a similar poison might be used. An eradication programme is apparently giving good results in the settled areas of Lord Howe Island, where the islanders have noticed the reappearance of native lizards and snails. It is understood that poisoning is also now being carried out on the top of Mt. Gower. It is certain that unless this part of the campaign is successful the Woodhens will not survive, as recent observation by Mr. Lindsay Hyem and Ray Schick (pers. comm.) have shown that the rats take many of the eggs. In order to retain the remaining native vegetation and permit regrowth, a vigorous campaign of goat and pig extermination must also be carried out and other usual protective measures taken to prevent

deterioration of the environment. The area on top of Mount Gower should immediately be completely protected from further alteration in any way in order to retain a suitable environment for the small, rapidly disappearing, population of woodhens.

ACKNOWLEDGEMENTS

We wish to thank the Lord Howe Island Board for permission to carry out this survey, the Board's Superintendent on the island and many islanders who helped us, in particular Mr. Phil Dignam and Paul and Bruce Thompson, who were our guides and helpers on Mt. Gower.

The late Mr. K. A. Hindwood took a great interest in our work on Lord Howe Island. We would like to record here our deep appreciation of his help and also our thanks to his correspondents, Mr. Norman Chaffer, Mr. Gary Sefton, and Mr. Alan Rogers, for allowing us to make use of their unpublished observations.

REFERENCES

Bell, R.—Manuscript Diary for the year 1913.

Delacour, J., 1966.—*Guide des oiseaux de la Nouvelle-Caledonie et de ses dependances.* Switzerland, 172 pp.

Hill, E. S., 1870.—*Lord Howe Island.* Sydney, 60 pp.

Hindwood, K. A., 1940.—The Birds of Lord Howe Island. *Emu,* 40 (1): 1-86.

Hindwood, K. A. and Cunningham, J. M., 1950.—Notes on the birds of Lord Howe Island. *Emu,* 50: 23-35, pl. 4.

Hull, A. F. Basset, 1909.—The Birds of Lord Howe and Norfolk Islands. *Proc. Linn. Soc., N.S.W.,* 34 (4): 636-693.

McCaskill, L. W., 1943.—The Invasion of New Zealand by Spine-tailed Swifts in the Summer of 1942-43. *N.Z. Bird Notes,* 1 (4): 38-40.

McKean, J. L. and Hindwood, K. A., 1965.—Additional Notes on the Birds of Lord Howe Island. *Emu,* 64 (2): 79-97.

Nicholls, M., 1952—"*A History of Lord Howe Island.*" Hobart, 1938. Revised edition about 1952 (undated), 148 pp.

Oliver, W. R. B., 1909.—The Vegetation of the Kermadec Islands. *Trans. Proc. N.Z. Inst.,* 42: 126.

Oliver, W. R. B., 1917.—The Vegetation and Flora of Lord Howe Island. *Trans. Proc. N.Z. Inst.,* 42: 126.

Oliver, W. R. B., 1917.—The Vegetation and Flora of Lord Howe Island. *Trans. Proc. N.Z. Inst.,* 49: 94-161, 3 figs. pls. X-XVI.

Sharland, M. S. R., 1929.—Land Birds of Lord Howe Island. *Emu,* 39 (1): 5-11, pls. 2, 3.

Smithers, C. N. and Disney, H. J. de S., 1969.—The Distribution of Terrestrial and Freshwater Birds on Norfolk Island. *Aust. Zool.,* 15 (2): 127-140.

ECTOPSOCUS PILOSOIDES SP.N. (PSOCOPTERA: PERIPSOCIDAE) FROM QUEENSLAND

by C. N. SMITHERS
The Australian Museum, Sydney.

(Figures 1-7)

Ectopsocus pilosoides sp. n.

FEMALE.

Coloration (in alcohol): Head and thorax brown. Median epicranial suture very dark and fine. Labrum a little darker than postclypeus. Genae as postclypeus. Antennae slightly paler than head. Eyes black. Ocelli pale, bordered internally with dark brown. Legs a little paler than head. Fore wings (fig. 1) hyaline, tinged with pale brown, a broad band parallel with the rounded wing apex being very slightly darker than the rest of the wing membrane; membrane adjacent to M_3 also a little darker. Abdomen pale, subgenital plate area darker.

Morphology. Length of body: 1.4 mm. Median epicranial suture fine and distinct. Vertex and frons with fairly strong setae. Eyes small, not reaching level of vertex when viewed from the side. IO/D: 3.2; PO: 0.75. Lacinia (fig. 6). Femora broad. Fore wing length: 1.3 mm. Fore wing with strong stigmapophysis. Pterostigma very slightly broader distally than proximally. Rs and M joined by a crossvein or meeting in a point. Wing margin with a few very fine, short setae, not easily seen, veins bearing small setae. Hind wing length: 0.9 mm. Hind wing glabrous. Epiproct rounded behind, well sclerotized except for an oval area, the hind margin of which coincides with the hind margin of the epiproct. The hind margin bears four large and four small setae; the smaller are restricted to the poorly sclerotized area, the larger arise from the margin one on either side of the midline and one on each side about half way towards the base of epiproct. The sclerotized area of the epiproct bears small, irregularly placed setae. Paraproct (fig. 4). Subgenital plate (fig. 2) bears on its inner surface a characteristically sculptured plate. The posterior lobes each bear four strong setae (one apical, two on outer margin and one on inner margin). Gonapophyses (fig. 7).

MALE.

Coloration (in alcohol). As in female; structures at apex of abdomen dark brown.

Morphology. Length of body: 1.4 mm. Eyes small, but a little larger than in female, not quite reaching level of vertex when viewed from the side. IO/D: 2.4; PO: 0.7. Femora broad. Measurements of hind leg: F: 0.25 mm.; T: 0.473 mm.; t_1: 0.161 mm.; t_2: 0.075 mm.; rt: 2.1:1.0. Fore wing length: 1.4 mm. Fore wings as in female. Hind wing length 1.0 mm. Epiproct and dorsal structures at hind end of abdomen (fig. 5). Phallosome (fig. 3).

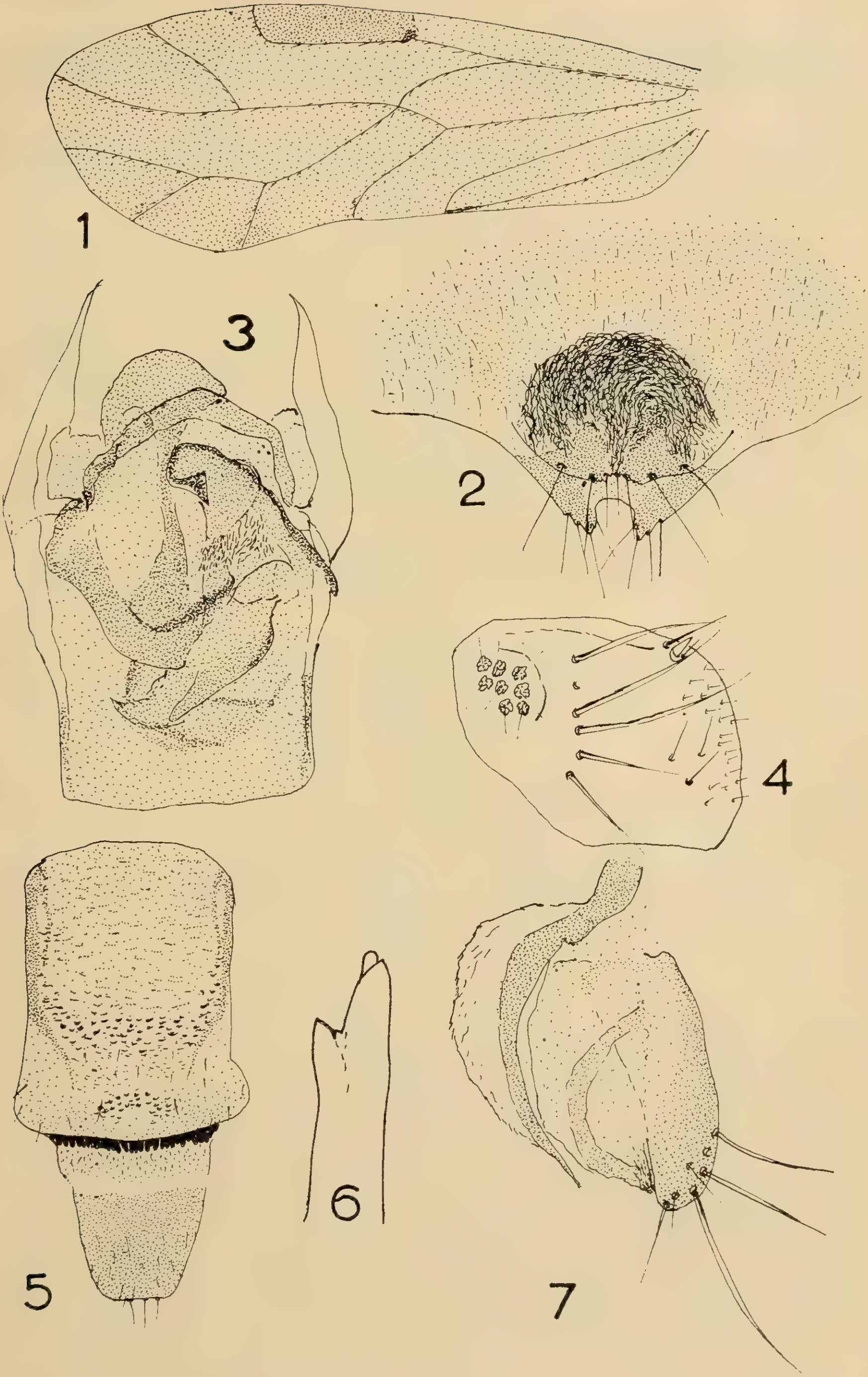
MATERIAL EXAMINED.

Holotype ♀, allotype ♂, a very long series of ♂ and ♀ paratypes, ex wheat, Darling Downs, October-November, 1967 (*P. D. Rossiter*).

The holotype, allotype and most of the paratypes will be deposited in the Queensland Museum, Brisbane; 3♂, 2♀ paratypes in The Australian Museum, Sydney.

DISCUSSION

This species is related to members of the *Ectopsocus hirsutus* group as defined by Thornton and Wong (1968, p. 145) in that the femora are somewhat



Figures 1-7.—*Ectopsocus pilosoides* sp. n. 1. ♀, fore wing; 2. ♀ subgenital plate; 3 ♂, phallosome; 4. ♀, paraproct; 5. ♂, 9th tergite and epiproct! 6. ♀, lacinia; 7. ♀, gonapophyses.

broadened. In female genitalic characters, however, it resembles *E. titschacki* Jentsch and *E. pilosus* Badonnel but the sculpturation of the subgenital plate is distinctive. The male can be distinguished from other members of the genus by the form of the 9th abdominal tergite and the sclerification of the penial bulb.

Champ and Smithers (1966, p. 261) have referred to this species as "*Ectopsocus* sp., prob. sp. nov." and have given other Queensland localities.

ACKNOWLEDGEMENT

I would like to thank Dr. A. R. Brimblecombe for the opportunity of examining this material.

REFERENCES

Champ, B. R. and Smithers, C. N., 1966.—The Insects and Mites associated with stored products in Queensland. 1. Psocoptera. *Qd. J. Agric. Anim. Sci.*, 22(3):259-262.

Thornton, I. W. B. and Wong, S. K., 1968.—The Peripsocid fauna (Psocoptera) of the Oriental Region and the Pacific. *Pacific Ins. Monogr.*, 19:1-158, 302 figs.

A COLLECTION OF PSOCOPTERA (INSECTA) FROM WESTERN AUSTRALIA INCLUDING FOUR NEW SPECIES

by C. N. SMITHERS
The Australian Museum, College Street, Sydney.

(Figures 1-25)

Through the courtesy of Dr. C. F. H. Jenkins I have been able to examine a collection of Psocoptera from the Department of Agriculture, Perth, Western Australia. Previously published records for the State are to be found in Enderlein (1907), McLachlan (1866) and Smithers (1963). This paper records thirteen species of which four are new.

Family TROGIIDAE

Lepinotus inquilinus Heyden.

2♂, ex crates from New Zealand, Trayning, 19.vi.1968. *Note*: This is a cosmopolitan domestic species, recorded from Queensland, New South Wales and Tasmania as well as from New Zealand.

Lepinotus patruelis Pearman.

5♀, ex barley straw from France, Civil Aviation Department, Graylands, 25.i.1965. *Note*: A widespread domestic species, including France, not previously recorded from Australia.

Family PSYLLIPSOCIDAE

Psyllipsocus ramburi Selys-Longchamp.

3♀, 1 nymph, ex skirting boards of new house, Applecross, 27.viii.1954. *Note*: A widespread domestic and cave species.

Family PERIPSOCIDAE

Ectopsocus cinctus Thornton

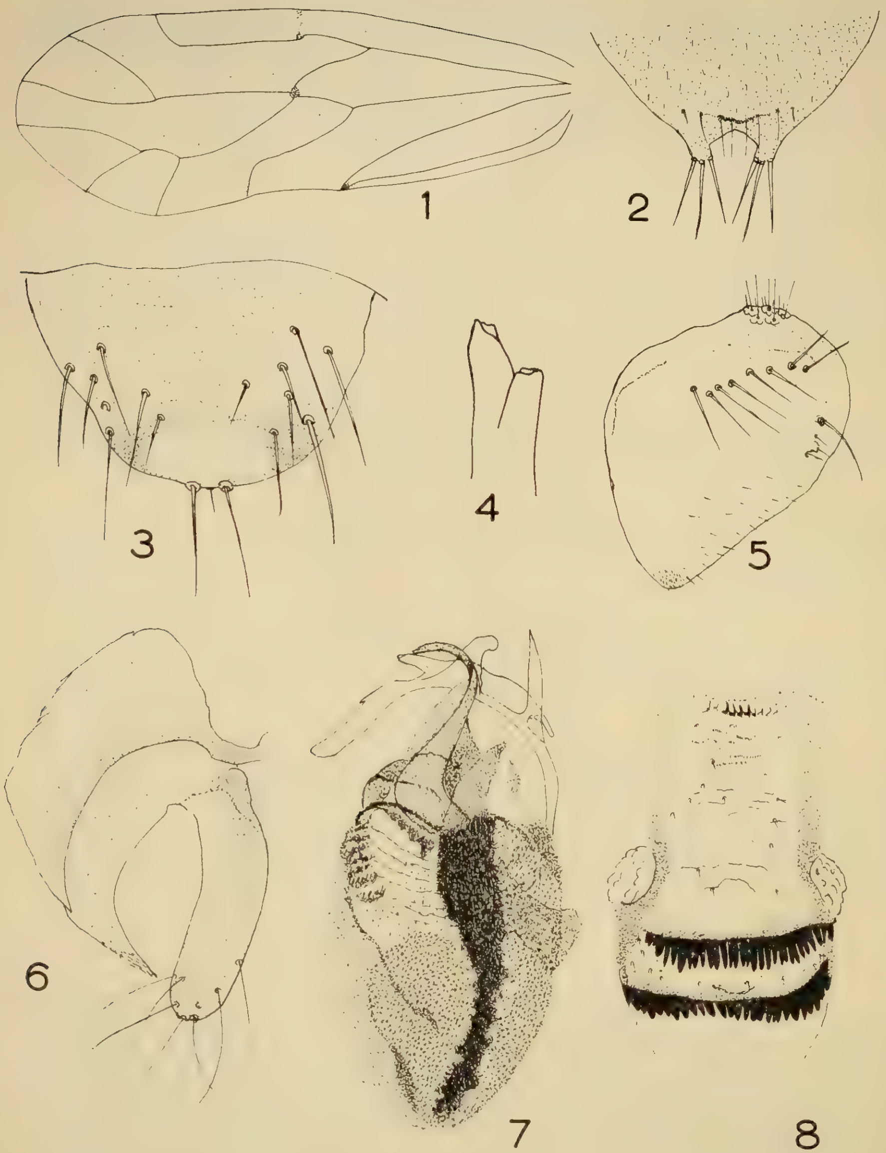
2♂, 2♀, Kununurra, Western Australia, 27.iii.1969; 3♀, 1 nymph, same locality, 13.iii.1969; 2♀, same locality, 4.iv.1969, L. R. Greenup. This species was described from Hong Kong and subsequently recorded from India, Malaya and Vietnam (Thornton and Wong, 1968, *Pacific Ins. Monogr.* 19:13) and has been taken in an aerial sample off Nicaragua (Thornton and Harrell, 1965, *Pacific Insects* 7:701). It has not previously been recorded from Australia.

Ectopsocus cetratus sp. n.

(Figures 1-8)

FEMALE.

Coloration. Head brown with dark brown confluent spots adjacent to the compound eyes, across the vertex and adjacent to the median epicranial suture. Frons pale with a dark spot anterior to median ocellus above epistomial suture. Postclypeus marked strongly with dark brown stripes which converge in the midline. Posteriorly the stripes are straight, becoming strongly curved in the anterior part of the postclypeus. Labrum pale with a dark spot on either side of the midline on the anterior margin as is usually the case. Genae brown. Antennae uniformly pale brown. Eyes black. Ocelli pale, bordered internally with brown. Maxillary palp with first and second segments pale, third brown, fourth dark brown. Dorsum of mesothorax dark brown, pale along sutures and with a fine median, longitudinal pale stripe; centre of scutellum pale. Legs brown, second tarsal segment a little darker than remaining leg segments. Fore wings (fig. 1) hyaline, faintly tinged with brown, a little darker at the ends of veins and at junction of Rs and M. Abdomen pale, with faint irregular suggestions of darker annulation; apical structures brown.



Figures 1-8.—*Ectopsocus cetratus* sp.n. 1. Fore wing, ♀; 2. Subgenital plate, ♀; 3. Epiproct, ♀; 4. Lacinia, ♀; 5. Paraproct, ♀; 6. Gonapophyses, ♀; 7. Phallosome, ♂; 8. Apical abdominal sclerifications, ♂.

Morphology. Length of body 2.0 mm. Vertex smoothly rounded, median epicranial suture distinct; pubescence fine and short. Postclypeus not prominent. Length of antennal segments: f_1: 0.27 mm.; f_2: 0.17 mm. Eyes fairly small, not reaching level of vertex when viewed from the side. IO/D: 4.5; PO: 1.4. Lateral ocelli large, anterior ocellus very small. Lacinia (fig. 4). Measurements of hind legs: F: 0.38 mm.: T: 0.68 mm.; t_1: 0.23 mm.; t_2: 0.10 mm.; rt: 2.3: 1.0; ct: 13, 0. Fore wing length: 2.0 mm.; fore wing width; 0.7 mm. Fore wing (fig. 1) as usual in the genus. Rs and M meeting in a point in most specimens. Setae on veins small and sparse. Epiproct (fig. 3) with two very strong posterior setae. Paraproct (fig. 5). Subgenital plate (fig. 2). Gonapophyses (fig. 6).

MALE.

Coloration. As a female.

Morphology. Length of body: 1.8 mm. Lengths of antennal segments: f_1: 0.325 mm.; f_2: 0.175 mm. Eyes fairly small, not reaching level of vertex when viewed from the side. IO/D: 2.7; PO: 0.66. Ocelli as in female. Measurements of hind leg: F: 0.40 mm.; T: 0.725 mm.; t_1: 0.25 mm.; t_2: 0.1 mm.; rt: 2.5: 1.0; ct: 15, 0. Fore wing length; 1.9 mm.; fore wing width: 0.6 mm. Abdomen with characteristic apical dorsal sclerotizations (fig. 8). Phallosome (fig. 7).

MATERIAL EXAMINED:

7♀♀, 6♂♂, Southern Cross, Western Australia, ix.1955. Holotype ♀, allotype ♂, paratypes in The Australian Museum; paratypes in Department of Agriculture, Perth, Western Australia.

Ectopsocus is a large genus. *E. cetratus* is easily distinguished by the form of the subgenital plate and gonapophyses of the female and by the form of the phallosome and apical sclerotizations of the male abdomen. The presence of such sclerotizations is a characteristic feature of *Ectopsocopsis*. The form of the female subgenital plate and of the gonapophyses leaves no doubt that the present species should be regarded as an *Ectopsocus,* although the sclerotizations of the male abdominal apex make it possible to regard this species as an intermediate one. When the world fauna of these two genera becomes better known a regrouping of species may be necessary.

Peripsocus macropterus Edwards.

4♂, Carmel, 6.ix.1950. F. E. Ryan.

Peripsocus milleri (Tillyard).

19♀, Harvey, 12.i.1954. B. A. Edwards.

Family ELIPSOCIDAE

Propsocus pallipes (McLachlan).

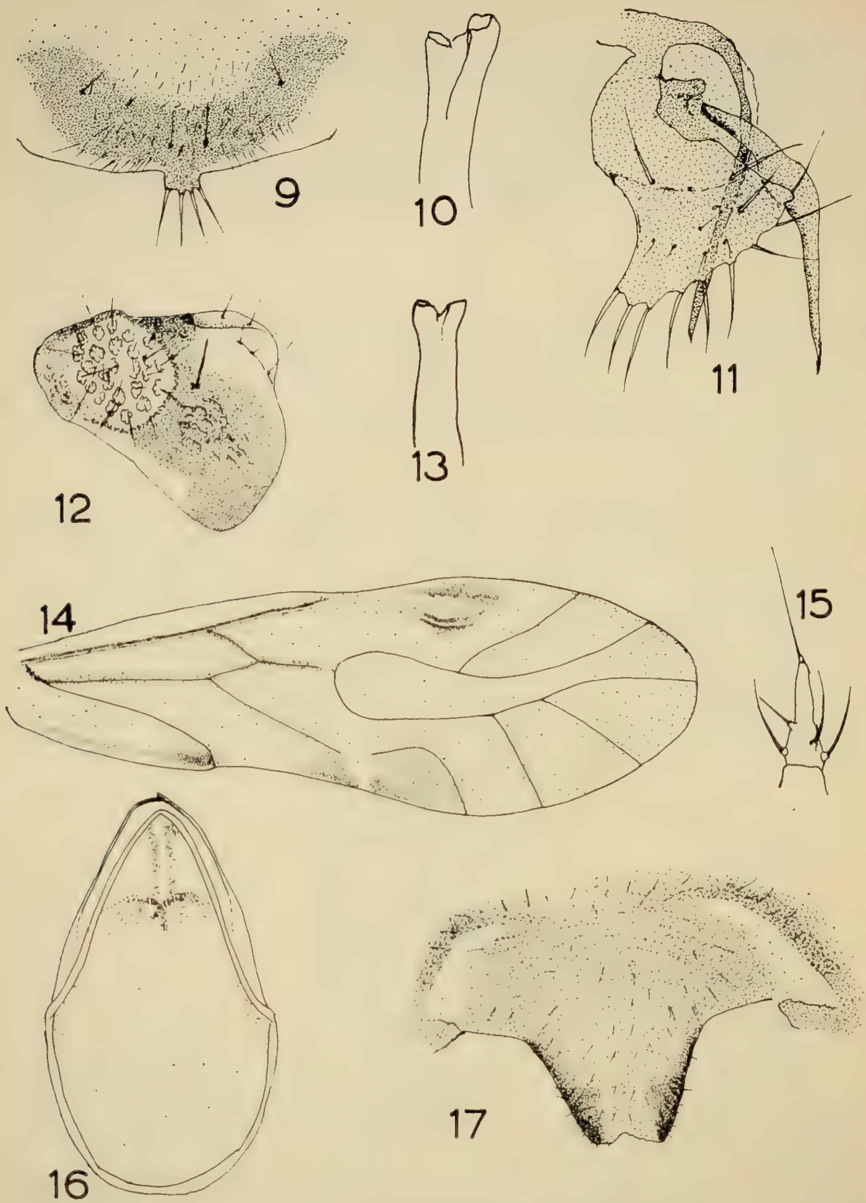
46♀, 29♂, Southern Cross, September, 1955.

Nepiomorpha phragmitella sp. n.
(Figures 9-11)

FEMALE.

Coloration. Head pale chestnut brown. Epicranial suture darker. Antennae uniformly brown. Eyes black. Maxillary palp brown. Pronotum dorsally pale brown with a dark dorsal ridge. Meso- and metanotum brown with an irregular interruption in the midline. Legs brown. Abdomen marked with irregular brown annulations.

Morphology. Of nymphoid facies. Length of body 2.2 mm. Median epicranial suture distinct; anterior arms poorly defined but visible. Vertex rounded, sloping anteriorly into frons and postclypeus, the latter only slightly bulbous. Setae short, fairly dense and blunt-ended. Antennae short, 13-segmented, the joint between the twelfth and thirteenth segment somewhat less distinct than others. Thirteenth segment extended into a small cylindrical papilla. Length of antennal segments: f_1: 0.116 mm.; f_2: 0.091 mm. Antennae short. Eyes very small, situated on the sides of the head well below the vertex.



Figures 9-11.—*Nepiomorpha phragmitella* sp.n. 9. Subgenital plate, ♀; 10. Lacinia, ♀; 11. Gonapophyses, ♀.

Figures 12-17.—*Haplophallus capitulatus* sp.n. 12. Paraproct, ♂; 13. Lacinia, ♂; 14. Fore wing, ♂; 15. Distal segment of antenna, ♂; 16. Phallosome, ♂; 17. Hypandrium, ♂.

IO/D and PO not measured as the eyes are too small. Ocelli absent. Lacinia (fig. 10). Prothorax narrow, ring-like, with a strong postero-dorsal ridge. Meso- and metathorax subequal, setose. Measurements of hind leg: F: 0.4 mm.; T: 0.6 mm.; t_1: 0.12 mm.; t_2: 0.1 mm.; rt: 1.2:1.0. Ctenidiobothria absent. Epiproct with rounded hind margin, setose. On either side near apex a strong seta between which are three short, strong, pointed, marginal setae. Paraproct ovoid, without trichobothrial field but three large setae on upper half of paraproct in addition to a few smaller setae. Ventral surface of paraproct beset with dense patch of small setae adjacent to which, a little dorsad, arise a few large setae. Posterior margin with a strong posterior cone flanked by setae. Subgenital plate (fig. 9) with a shallow median posterior lobe, bearing a row of about six strong marginal setae; transverse setal band reduced to a long row of setae reaching the margin of the subgenital plate on either side. Gonapophyses (fig. 11).

MALE.

Unknown.

MATERIAL EXAMINED:

31♀♀, ex fence, South Perth, Western Australia, 20.x.1961. Holotype ♀, paratype ♀♀ in The Australian Museum; paratype ♀♀ in Department of Agriculture, Perth.

DISCUSSION:

This species falls well within the definition of the Nepiomorphinae, of which there are four genera, *Nepiomorpha* Pearman, *Nothopsocus* Badonnel, *Paedomorpha* Smithers and *Roesleria* Badonnel. It cannot be placed in *Roesleria* nor *Paedomorpha* as it has the ventral valve of the gonapophyses fully developed and not reduced to a small membranous flap. It agrees with *Nepiomorpha* in having 2-segmented tarsi, in having a single cone on the paraproct margin, in the form of the subgenital plate, in being apterous in the females (males unknown) and in the form of the genitalia. It has, however, short, 13-segmented antennae (in *Nepiomorpha* reduced to 11 segments). *Nothopsocus* has 3-segmented tarsi, two paraproct cones and has the setae of the subgenital plate lobe in two groups. It is interesting to note that *Nepiomorpha crucifera* Pearman (the type species of the genus) also has this grouping. The present species is very similar to other species of *Nepiomorpha* and is included with them despite the number of antennal segments; the erection of yet another genus in the Nepiomorphine complex to accommodate this species is not warranted.

Paedomorpha gayi Smithers.

7♀, Cottesloe, 26.vi.1961.

Family PHILOTARSIDAE

Haplophallus capitulatus sp. n.
(Figures 12-17)

MALE.

Coloration (in alcohol). Head pale brown with a few dark brown, confluent spots adjacent to compound eyes and median epicranial suture and with dark brown surrounding the ocelli. Postclypeus with brown lines converging anteriorly. Anteclypeus pale, dark adjacent to postclypeus. Labrum dark brown. Genae pale, without markings. Antennae brown, scape, pedicel and first flagellar segment a little paler than remaining segments. Eyes very dark purple, almost black. Ocelli dark. Maxillary palp with first and second segment very pale, third and fourth segments very dark brown. Mesothorax with very dark brown notum, pale along sutures and with pale scutellum. Legs brown. Fore wings (fig. 14) hyaline, marked in shades of brown. Veins dark brown. Hind wings hyaline, very faintly tinged with brown, with a pale brown patch behind end of Cu_2. Abdomen pale, terminal structures dark brown.

Morphology. Length of body: 2.2 mm. Anterior arms of epicranial suture indistinct. Lengths of antennal segments: f_1: 0.406 mm.; f_2: 0.280. Setae on first flagellar segment almost as long as width of segment. Thirteenth segment of antenna (fig. 15) narrowing apically and with a long terminal reta. Eyes fairly large, hemispherical. IO/D: 2.0; PO: 0.85. Ocelli large, especially lateral ocelli. Lacinia (fig. 13). Dorsal surface of mesothorax with fairly long, colourless setae. Measurements of hind leg: F: 0.52 mm.; T: 1.0 mm.; t_1: 0.31 mm.; t_2: 0.08 mm.; t_3: 0.09 mm.; rt: 3.0:1.0:1.1; ct: 14, 0, 0. Fore wing length: 3.8 mm.; fore wing width: 1.3 mm. Fore wings (fig. 14) broadly rounded apically. Costal area broad; distal half of Sc evanescent and stigmapophysis reduced to a small rudiment. Pterostigma broad, with very few setae. R_2+_3 curving gently away from R_4+_5 in distal quarter. Rs and M diverging strongly after separation, the veins at point of separation pale. Culb evanescent and also Cu_{1a} for a short length after separation from Culb. Hind wing length: 3.0 mm.; hind wing width: 1.0 mm. Epiproct broad, simple, almost devoid of setae except for a few scattered adjacent to posterior margin; surface of epiproct finely sculptured. Paraproct (fig. 12) broad with large round field of trichobothria; a dorsal, sclerotized ridge runs posteriorly from the dorsal side of the trichobothrial field. The degree of sclerotization of the remainder of paraproct varies and, apart from one large seta just posterior to trichobothrial field, there are only a few scattered setae on the distal, lightly sclerotized, part of the paraproct. Hypandrium (fig. 17) well sclerotized, bearing small, fine setae, narrowing posteriorly with a narrow, emarginate hind margin; lateral margins curved dorsally to form a basin in which lies the phallosome. Phallosome (fig. 16).

FEMALE.

Unknown.

MATERIAL EXAMINED.

2♂, Southern Cross, Western Australia, September, 1955. 1♂, Perth, Western Australia, 2.ix.1940 P. M. Forte. Holotype ♂ in The Australian Museum; paratypes in Department of Agriculture, Perth, Western Australia.

DISCUSSION.

This species differs from *H. basilewskyi* (Smithers) in wing colour, from *H. fenestrstigma* (Enderlein) in the colour pattern of the pterostigma, from *H. greyi* (Edwards) in phallosome form and ratio of lengths of hind tarsal segments, from *H. guttatus* (Tillyard) in wing pattern and from *H. maculatus* (Tillyard) and *H. orientalis* Thornton in colour pattern of pterostigma and phallosome form.

Family PSOCIDAE

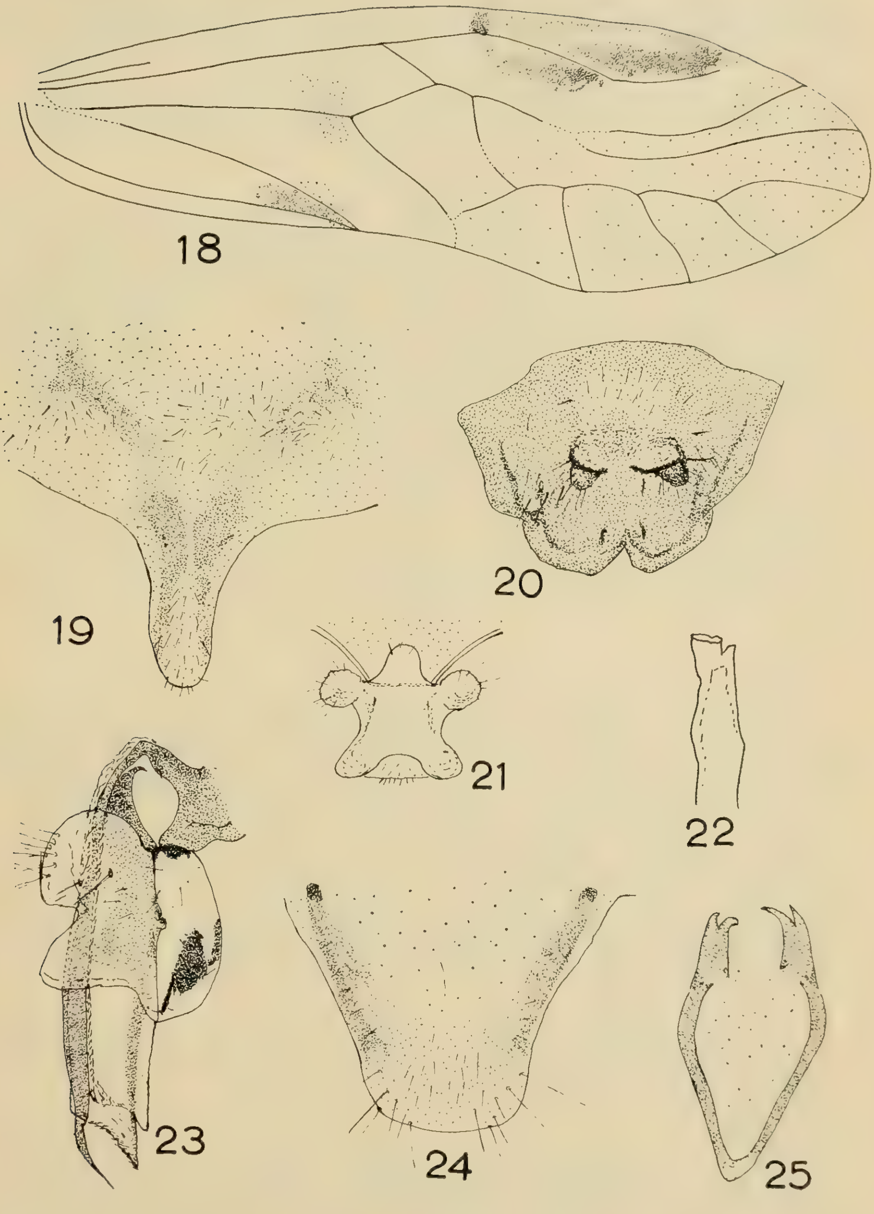
Blaste (*Lasiopsocus*) *michaelseni* (Enderlein).

1♀, 1♂, Nedlands, 3.vii.1940, P. N. Forte. 1♀, Nedlands, 15.vi.1940, P. N. Forte. 2♀ Nedlands, 10.vii.1940, P. N. Forte. 2♂, Nedlands, 14.vii.1940, P. N. Forte. 1♀, 6.viii.1941, P. N. Forte.

Psocidus notialis sp. n.
(Figures 18-25)

FEMALE.

Coloration. Head pale buff, with brown spotting on either side of the epicranial suture, across the back of the vertex and adjacent to the compound eyes. When seen from above under low magnification the head appears brown with a pale band on either side running forward to the ocellar triangle and then deflecting outwards to the antenna bases. Area immediately in front of ocellar triangle bears a brown ovoid mark with a pale centre. Postclypeus pale buff with fine pale brown lines running parallel with one another from epistomial suture to anteclypeus, the lines hardly converging. Labrum pale with a median, brown, almost semicircular mark, the arms of the semicircle facing forwards. Genae pale, not marked. Scape, pedicel and first flagellar segment pale;



Figures 18-25.—*Psocidus notialis* sp.n. 18. Fore wing, ♀; 19. Subgenital plate, ♀; 20. Hypandrium, ♂; 21. Epiproct, ♂; 22. Lacinia, ♀; 23. Gonapophyses, ♀; 24. Epiproct, ♀; 25. Phallosome, ♂.

remainder of antenna dark brown, almost black. Eyes black. Ocelli bordered internally with black. Maxillary palp pale, the fourth segment almost black. Mesothorax dorsally very dark brown the suture broadly bordered with pale buff as well as the median line of the antedorsum. Scutellum pale. Legs pale (except for dark hind coxae), with dark brown tarsi; there is a suggestion of a dark ring near the distal ends of the femora. Fore wings (fig. 18) hyaline with marking in various shades of brown. Hind wing hyaline, very faintly tinged with brown in region of wing apex anterior to R_{4+5} and in angle between Cu_2 and wing margin. Abdomen with basal segment dark brown above, otherwise pale; terminal structures dark brown.

Morphology. Length of body: 4.5 mm. Head with gently rounded vertex. Epicranial suture indistinct. Postclypeus large and strongly bulbous. Lengths of antennal segments: f_1: 0.82 mm.; f_2: 0.82 mm. Antennal pubescence very short. Eyes large, hemispherical, applied to sides of head, far from reaching vertex when viewed from the side. IO/D: 2.2; PO: 0.82. Ocelli small, closely grouped; anterior ocellus reduced. Lacinia (fig. 22). Measurements of hind leg: F: 0.72 mm.; T: 1.5 mm.; t_1: 0.3 mm.; t_2: 0.15 mm.; rt: 2.1; ct: 17, 0. Fore wing length: 4.8 mm.; fore wing width: 1.5 mm. Venation as in figure 18. Pterostigma with weak hind angle, Sc ending in membrane, indistinct. Rs and M fused for a long length. Rs very slightly sinuous before bifurcation, evanescent in distal half of fusion. Radial fork with small angle; R_{2+3} and R_{4+5} evanescent in basal sections, running almost parallel for a length, diverging more strongly half way to margin. M strongly curved after separation from Rs, giving a strongly concave discoidal cell. First and second sections of Cu_{1a} almost in a straight line, Culb evanescent. Cu_2 runs almost parallel with wing margin for most of its length. Fore wings glabrous. Hind wing length, 3.8 mm.; hind wing width: 1.1 mm. Hind wing with Rs and M fused for a length; glabrous. Epiproct (fig. 24). Subgenital plate (fig. 19) with long median posterior lobe. Gonapophyses (fig. 23).

MALE.

Coloration. As in female.

Morphology. Smaller than female. Length of body: 2.7 mm. Head with strongly bulbous postclypeus as in female. Lengths of antennal segments: f_1: 0.4 mm.; f_2: 0.4 mm. Antennal setae much longer than in female, in many cases longer than diameter of antenna. Eyes relatively much larger than in female; strongly protruding, just reaching level of vertex when viewed from the side. IO/D: 1.3; PO: 0.82. Ocelli relatively larger than female. Fourth maxillary palp segment three times long as wide. Antennae with long, fine slightly recurving setae; measurement of hind leg: F: 0.6 mm.; T: 1.25 mm.; t_1: 0.27 mm.; t_2: 0.12 mm.; rt: 2.2:1.0; ct: 13, 0. Fore wing length: 3.9 mm.; fore wing width: 1.3 mm. Fore wing relatively longer and with more gently rounded apex than in female. Venation generally similar to female but with R_1 forming pterostigma less strongly curved. Epiproct (fig. 21), with three anterodorsally projecting rounded lobes. Hypandrium (fig. 20). Phallosome (fig. 25).

MATERIAL EXAMINED.

2♀, 1♂, Southern Cross, Western Australia, September, 1955. Holotype ♀ and allotype ♂ in The Australian Museum; paratype in Department of Agriculture, Perth, Western Australia.

DISCUSSION.

This species resembles *Clematostigma maculiceps* (Enderlein) and *Clematostigma tardipes* Edwards. It is easily distinguished from the former by the lack of a dark band in the position of the anterior arms of the epicranial suture and from the latter by the more elongate subgenital plate, the form of the apex of the phallosome and the hypandrium. It is clearly closely related to these species but falls outside the definition of *Clematostigma* Enderlein, of which the distinguishing feature is a pterostigmal spurvein (lacking in *Ps. notialis*). *Clematostigma*, however, is in need of reinvestigation in order

to determine its validity and until this is undertaken *Ps. notialis* is better placed in *Psocidus*. When the position of *C. tardipes* and *C. maculiceps* has been determined *Ps. notialis* will probably be found to be congeneric with them.

Family MYOPSOCIDAE

Myopsocus griseipennis (McLachlan).

1♂, Claremount, 14.x.1951. 2♂, Crawley, 28.x.1951, P. N. Forte. 3♂, 12♀, Harvey, 12.i.1954. B. A. Edwards.

REFERENCES

Enderlein, G., 1907.—Copeognatha. *In* Michaelsen, W. and Hartmeyer, R. *Die Fauna Südwest-Australiens. Ergebnisse der Hamburger Südwest-Australischen Forschungsreise 1905.* Vol. 1: 233-240, 6 figs.

McLachlan, R., 1866.—New genera and species of Psocidae. *Trans. ent. Soc. Lond.* (3) 5: 345-352.

Roesler, R., 1944.—Die Gattungen der Copeognathen. *Stettin. ent. Ztg.* 105: 117-166.

Smithers, C. N., 1963.—The Elipsocidae of Australia. *Pacific Ins.* 5 (4): 885-898, 25 figs.

STUDIES ON THE NEUROSECRETORY CELLS OF THE BRAIN OF NORMAL AND STARVED RED COTTON BUGS, **DYSDERCUS KOENIGII** (FABR.) (HETEROPTERA, PYRRHOCORIDAE)

by V. B. AWASTHI
Department of Zoology, University of Jodhpur,
Jodhpur, India

(Plate 1)

SYNOPSIS

The structural changes in the neurosecretory cells of the brain of normal and starved red cotton bugs, *Dysdercus koenigii,* have been described.

INTRODUCTION

Very few attempts have been made to study the structural changes in the neurosecretory cells of starved insects. The only available reference is that of Brassurmanova and Panov (1967) who have described the ultrastructure of A-type neurosecretory cells in the brain of normal and starved larvae of the silk worm, *Bombyx mori.* In the present work an attempt has been made to study the effect of starvation in the neurosecretory cells of the brain of *Dysdercus koenigii.*

MATERIAL AND METHODS

The adult insects of mixed age were collected from the plants of cotton, *Gossypium indicum,* and kept in a cage in the laboratory. They were provided with green bolls and flowers of the *Gossypium indicum,* to serve as control insects. A petri dish containing moist cotton was placed in the cage for maintaining humidity. In another cage some insects were starved for seven days. The proper humidity was maintained as in the controls. The brains of normal and starved insects were dissected in the physiological saline, fixed in 10% formol-saline for 18 hours and were oxidised with formic acid—H_2O_2 oxidant. They were stained with the Performic acid Victoria blue (PAVB) technique of Braak (1962) and Dogra and Tandan (1964).

OBSERVATIONS AND DISCUSSION

In the protocerebrum of *D. koenigii,* there are two medial groups consisting of 18 A-type neurosecretory cells. They are more or less oval or spherical in form (Fig. 1). In the normal individuals the cell cytoplasm is seen with a large number of small granules that are positively stained with PAVB technique (Fig. 1). The granules are loosely distributed in the entire cytoplasm. These granules contain space in them and are not densely packed. The nuclei are distinct and are negative to PAVB stain.

In the starved bugs, the neurosecretory cells reveal interesting changes in their cytomorphology. The cells are stained intensely (Fig. 2). Almost all the cells show a heavy accumulation of PAVB positive material inside them. Deformity and clumping of granules in the cells of starved bugs is another noteworthy point. The spaces observed in the neurosecretory cells of the normal bugs are lacking (compare Figs. 1 and 2). The entire cytoplasm is filled with deeply stained neurosecretory product. However, a few cells are seen lightly stained due to the presence of a small amount of NSM.

Bassurmanova and Panov (1967) have shown almost similar results in the A′-cells (comparable to A-cells of the present material) of larvae of *B. mori* starved for 2 to 4 days. They have further observed increased size of neurosecretory granules and decreased spaces in between them. The entire cytoplasm is filled with intensely PF positive neurosecretory material.

But these authors, in spite of the above observations, have not given any possible reason for such a change in the cytomorphology of starved silkworms. The present study suggests, that, in the normal condition, perhaps the rate of synthesis and the rate of discharge of NSM run on parallel lines which do not run during starvation due to some intrinsic factor(s) (food may be the one). Perhaps, the release of NSM is inhibited. Obviously it results in the clumping of neurosecretory granules and decrease of space in the cytoplasm. Therefore, it is of considerable significance to note that due to the lack of discharge of NSM in starved insects the material synthesised is stored in the perikarya. It is discharged only when other factor(s) that control the release of NSM are favourable.

Conclusively it appears that starvation influences the neurosecretory activity (which is completed in three phases—synthesis, transport and release of secretion—Bassurmanova and Panov. 1967) by inhibiting the release of NSM.

SUMMARY

1. In *D. koenigii* there are 18 A-type neurosecretory cells in the medial groups.
2. In the normal individuals the granular NSM is uniformly distributed in the entire cytoplasm. The granules are provided with space in between them.
3. The starved individuals show deformity in the cells, clumping of material and lack of space in between the granules. The cytoplasm is stained deeply and homogeneously.
4. The result of starvation on the neurosecretory activity is the inhibition of release of NSM.

ACKNOWLEDGEMENT

The author is grateful to Professor S. D. Misra, Head of the Zoology Department, University of Jodhpur, for his helpful suggestions and encouragement.

REFERENCES

Bassurmanova, O. K. & Panov, A. A., 1967.—Structure of neurosecretory system in Lepidoptera. Light and electron microscope study of type-A'-neurosecretory cells in the brain of normal and starved larvae of the silk worm, *Bombyx mori. Gen. Comp. Endocr.*, 9: 245-262.

Braak, H., 1962.—Eine methods Zur räumlichen Darstellung des neurosekretorischen Zwischenhirn-Hypophysensys tems. *Mikroskopie*, 17: 344-347.

Dogra, G. S. & Tandan, B. K., 1964.—Adaptation of certain histological techniques for *in situ* demonstration of the neuro-endocrine system of insects and other animals. *Quart. J. Micr. Sci.*, 105: 455-466.

OBSERVATIONS ON SOME AUSTRALIAN FOREST INSECTS

25. ADDITIONAL INFORMATION ON SOME PARASITES AND PREDATORS OF LONGICORNS (CERAMBYCIDAE: PHORACANTHINI)

by K. M. MOORE
Forestry Commission of New South Wales, Sydney.

(Plate II; text-figures 1-7)

INTRODUCTION

Observations on a number of parasites, hyperparasites and predators of *Phoracantha semipunctata* (F.) and related species of the Tribe Phoracanthini were previously recorded (Moore 1963).

During 1968 to 1970 more than 6,000 specimens of three braconid parasites previously studied (*Syngaster lepidus* Brullé; *?Bracon capitator* F.; and *Doryctes* sp.) were collected by the writer from Ourimbah, Wyong and Olney State Forests in the Wyong Subdistrict, New South Wales and despatched to South Africa so that they might be cultured and distributed in areas where damage by *P. semipunctata* was of economic concern in plantations of *Eucalyptus* spp. in that Republic.

Additional information, gained during the numerous collections of these parasites made at altitudes of from 100′ to 900′ on the Central Coast of New South Wales, is recorded below.

All species of those parasites, hyperparasites and predators previously recorded, were found to be exerting varying degrees of control of the cerambycid larvae attacking logs, during different seasons.

(A) BRACONIDAE

Some 2,500 specimens of the braconid *Syngaster lepidus* were collected and despatched to the Plant Protection Research Institute, Pretoria, during 1968 to 1970.

When collecting and handling the specimens, it was noticed that extreme variability in the size and coloration of cocoons occurred. The larger cocoons (of *S. lepidus*) were pale to dark brown in colour, while the smaller cocoons were pale brown to white.

The smaller adult specimens appeared to move more vigorously than the adults of *S. lepidus*, and the female ovipositors were longer in proportion to the total body length than those of the larger female specimens.

S. lepidus appears to attack the more mature longicorn larvae, and those larvae attacked by the smaller braconid species had usually constructed only about half of their working before they were immobilised and destroyed.

It thus appears that more than a single taxon is represented by the total complex of *S. lepidus* specimens attacking cerambycid larvae of the Tribe Phoracanthini.

(B) COLYDIIDAE

Species in this family were previously recorded to be predatory on longicorn larvae (Moore 1963), and the various species of colydiid beetles then recorded, were again usually present in low numbers only. However, during November, 1969, the species *Bothrideres vittatus* Newm., which is usually present in greater numbers than the other colydiid species, accounted for 100% mortalities in a large population of longicorn larvae heavily infesting several contiguous logs.

Larvae which had spun their cocoons before the collections were made, commenced emerging during December, and then remained alive in separate containers and without feeding, for up to four months.

Two adults emerged from one cocoon of *S. lepidus,* one beetle being considerably larger and darker brown than the other specimen.

Cocoons spun by larvae of *B. vittatus* and *Deretaphrus ignarus* Pasc. are shown in Plate II (fig. A). Cocoons of the former species are readily recognised by their smaller size (c. 4 mm.) together with their dull creamy-yellow coloration; those of the latter species by their large size (c. 9 mm.) and their shiny dark brown colour. The habits of the species were essentially the same as had previously been reported, but it was also determined that the larvae and adults of these two species were predatory on the parasites and hyperparasites of longicorns.

Two adults of *D. ignarus* emerged during February from cocoons collected during the previous December.

(C) MELANDRYIDAE

During March, 1970, a coleopterous pupa was taken at the end of a completed working of a longicorn larva, and alongside a destroyed larva of a late instar.

The adult specimen, which emerged on 16 March, was determined as *Talayra ?elongata* (Macl.) of the family Melandryidae.

There is no doubt that the longicorn larva had been destroyed by the larva of *T. elongata,* and this appears to be the first record of the parasitic or predatory habit of a species in this family.

(D) ASILIDAE

The unusual occurrence of an asilid (or "robber-fly") larva attacking longicorn larvae, was previously recorded (Moore 1963, p. 225), and some brief notes on the biology of the species concerned were also given.

Imms (1948) mentions that a larva of the genus *Laphria* has been found beneath bark and in the workings of longicorn larvae, but this appears to be the first record of an Australian species of Asilidae predatory on longicorn larvae.

The identification of the adult specimens was given by the late Dr. S. J. Paramonov, previously of the Division of Entomology, C.S.I.R.O., Canberra, on an examination of the adults reared by the writer, from the larval stage. They were assigned to the genus *Brachyrrhopala,* and the specimens are at present in the National Insect Collection at Canberra. One specimen has been labelled as holotype of a new species, which Dr. Paramonov proposed to name for the writer.

The material submitted, and figured in Text-figs. 1 to 7 and Plate II figs. B & C, was collected at Lisarow, New South Wales, under the bark of a log of *Angophora floribunda* (Sm.) Sweet. During the 1968-1970 collections of material, the whitish larvae of this species were more numerous beneath the bark of *Eucalyptus microcorys* F. Muell. logs, than when the previous investigations on the logs of *A. floribunda* were made during a series of wet years when about twice the average annual precipitation occurred on the area for several years.

Larvae of various instars may be found during most months of the year, thus indicating a continuous overlap of generations.

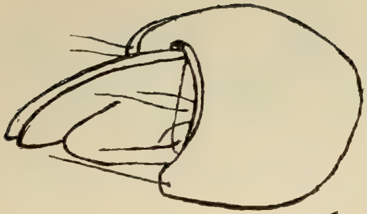
(E) TACHINIDAE

A dipterous puparium was found beside a flaccid longicorn larva under the bark of a log in Compartment 35 of Wyong State Forest on 20 November, 1968.

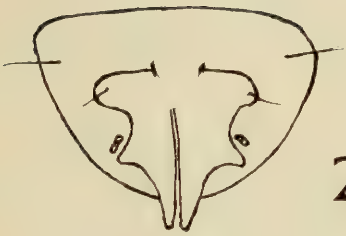
The adult specimen, which emerged on 5 December, 1968, was identified by Dr. R. W. Crosskey, of the British Museum, as *?Platytainia* sp. Apparently nothing was previously known of the habits of species in this genus.

ACKNOWLEDGEMENTS

The writer is grateful to Messrs. R. Moulton and J. M. Walburg van Gent, of the Photographic Section, Forestry Commission of N.S.W., for the photographs of the colydiid cocoons reproduced in this paper.



1

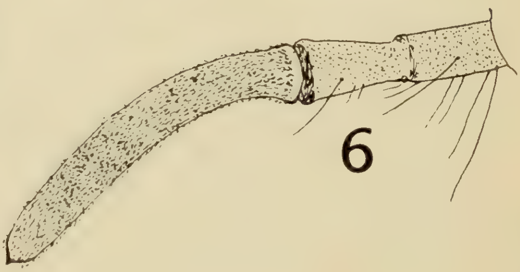


2

3

4

5



6

7

REFERENCES

Imms, A. D., 1948.—A Textbook of Entomology. (7th Edn.) Methuen & Co., London. 727 pp.

Moore, K. M., 1963.—*Some Mortality Factors of *Phoracantha semipunctata* (F.) (Coleoptera: Cerambycidae). *Proc. Linn. Soc. N.S.W.*, *88* (2): 221-229.

* The caption to Plate xiii in this paper should be corrected to read "------ *Doryctes* sp. (3), *Cyanoxorides* sp. (4)".

Figure 1.—*Brachyrrhopala* sp. (ASILIDAE). Head capsule, last instar larva (lateral).

Figure 2.—*Brachyrrhopala* sp. (ASILIDAE). Head capsule, last instar larva (anterior).

Figure 3.—*Brachyrrhopala* sp. (ASILIDAE). Head capsule, last instar larva (ventral).

Figure 4.—*Brachyrrhopala* sp. (ASILIDAE). Setae on posterior segment, last instar larva (ventral).

Figure 5.—*Brachyrrhopala* sp. (ASILIDAE). Pupa, with larval head capsule and exuviae attached to posterior abdominal segments, (c. x 18).

Figure 6.—*Brachyrrhopala* sp. (ASILIDAE). Antenna of female adult, (c. x 80).

Figure 7.—*Brachyrrhopala* sp. (ASILIDAE). Wing of female adult, (c. x 14).

OBSERVATIONS ON SOME AUSTRALIAN FOREST INSECTS

26. SOME INSECTS ATTACKING THREE IMPORTANT TREE SPECIES

by K. M. MOORE
Forestry Commission of New South Wales.

(Figures 1-2.)

INTRODUCTION

Of the various eucalypt tree species of economic importance occurring along the coast and the eastern slopes of the Great Dividing Range in New South Wales, and which are valued as a source of timber scantlings, the species *Eucalyptus pilularis* Smith (blackbutt) is in considerable demand for building purposes. Another species, *E. grandis* Smith (flooded gum), has also attained a similar economic status by virtue of its quick growth, straight stems, and the relative ease with which the timber can be worked for mouldings, etc.; a third timber type, *E. saligna* Smith (Sydney blue gum), is also regarded as a prime timber species.

Planned timber-stand-improvement in forest management favours these three species where they occur, and during recent years, the two former species have been extensively sown or planted in provenance trial plots in many areas, from seed obtained in various localities between Eden, in New South Wales, to Fraser Id. in Queensland.

Sowing and planting techniques for *E. pilularis* and *E. grandis* are recorded by Hurditch (1968).

Information concerning the complex of insect species which attack these three relatively important *Eucalyptus* spp. is limited, and investigations have been made over a number of years to determine the insect species causing damage to them.

This list, although by no means comprehensive, provides a basis for more intensive studies on any of these insects.

E. grandis and *E. saligna* are species of close affinities, and many of the insects attacking one of these species also appear to attack the other. A number of insects attack all three species, and further observations will probably increase that number.

Some insects associated with, but not necessarily attacking, *E. saligna* were previously recorded (Moore 1961).

About 180 species are presented here, in the alphabetical sequence of the relevant insect Orders, and the three host plant species are denoted by the following lettering:- g = *Eucalyptus grandis;* p = *E. pilularis;* s = *E. saligna.*

Those insects known to attack other host species, are prefixed with an asterisk, and that portion of the tree where damage occurs, is recorded.

COLEOPTERA

(Species of the Families Anobiidae, Bostrychidae, Brenthidae, Buprestidae, Cerambycidae, Curculionidae and Lyctidae all appear to attack logs and unhealthy or dead or dying trees, unless recorded otherwise).

ANOBIIDAE (furniture borers)

**Deroptilinus granicollis* Lea	s

BOSTRYCHIDAE (shot-hole borers)

**Bostrychoplites cylindricus* (Macleay)	s
**Xylion collaris* Erichson	s
**Xylopsocus gibbicollis* Macleay	s

BRENTHIDAE			
**Cyphagogus bipunctatus* Senna			s
C. delicatus Lea			s
BUPRESTIDAE (flat-headed borers)			
Nascio vetusta Boisd.			s
CERAMBYCIDAE (longicorn borers) (see also Duffy, 1963)			
**Bimia bicolor* White			s
**Coptocercus aberrans* Newm.			s
**C. biguttatus* (Don.)			s
**C. rubripes* (Boisd.)			s
Demonassa dichotomia Newm. (also in green stumps)			s
**Epithora dorsalis* Macl.			s
Hesthesis cingulata (Kirby) (kills young plants; see Moore 1966)	p		
Macrones rufus Saund.			s
**Phoracantha recurva* Newm.			s
**P. semipunctata* (F.) (see Moore 1963a)	p	g	s
**Tessaromma undatum* Newm.		g	s
**Tryphocaria acanthocera* (Macl.)		g	s
**T. solida* Blkb.		g	s
CHRYSOMELIDAE (leaf-beetles)			
(The species recorded here, attack young foliage)			
Chrysophtharta cloelia Stål.		g	
Edusella nr. *glabra*	p		
**Monolepta australis* (Jac.)	p		
Paropsis maculata Marsh.	p		
Paropsis sp.	p		
CURCULIONIDAE (weevils)			
Aterpus cultratus F. (young shoots on twigs & branches)			s
**Chrysolophus spectabilis* (F.) (foliage)	p		
Euops sp. (foliage)		g	s
**Gonipterus scutellatus* (Gyll.) (foliage)			s
G. exaratus Fhs. (foliage)			s
**Platypus australis* Frogg.			s
**P. incompertus* Schedl	p		
P. queenslandi Schedl			s
P. semigranosus Sampson			s
Protopalus sp. (branches)			s
Prypnus squamosus Blkb. (young foliage)	p		
Rhinaria concavirostris Lea (young twigs)			s
Xyleborus compressus Lea		g	s
**X. pseudoangustatus* Schedl			s
X. similis Ferr.			s
X. solidus Eichh.			s
**X. truncatus* Er.	p		s
EUMOLPIDAE			
Edusella ?distincta (Blkb.) (young foliage)	p		
E. nr. *glabra* Blkb. (young foliage)	p		
Odontionopa viridula Er. (young foliage)	p		
LYCTIDAE (powder-post borers)			
**Lyctus brunneus* (Steph.)			s
SCARABAEIDAE			
Diphucephala richmondia Macl. (young foliage)	p		
Liparetrus discipennis Guer. (young foliage)	p		

DIPTERA

THEREVIDAE			
? (said to deposit eggs under bark of logs)	p		
? (forms primary galls at tips of young shoots, & on leaves & petioles)		g	

HEMIPTERA

ACHILIDAE			
Tropiphlepsia ?badia Muir			s
ALEYRODIDAE (white-flies)			
*? *Neomaskellia eucalypti* Dumbleton (foliage)		g	s
APHIDIDAE (plant lice)			
**Aphis gossypii* Glov. (young foliage)		g	
CICADELLIDAE			
**Cicadella angustata* (Evans) (foliage)		g	
Erythroneura sp. (foliage)		g	
Idiocerus sp. (foliage)		g	
**Natipo rubrivenosa* (Kirk.) (foliage & twigs)	p		
Nirvana adelaidea Evans (foliage & twigs)		g	
Putoniessa maculata Evans (foliage & twigs)			s
Smicrocotis sidnica Kirk. (foliage)			s
Tartessus flavipes Spanberg (foliage & twigs)	p	g	
T. fulvus (Walk.) (foliage & twigs)			s
COREIDAE			
Amorbus rubiginosus Guer. (kills young shoots)	p		
DIASPIDIDAE			
Chrysomphalus trifasciculatus Brimblecombe (on bark)			s
**Lindingaspis* sp. (foliage)		g	
ERIOCOCCIDAE			
Apiomorpha nr. *minor* (Frogg.) (twigs)	p		
**Apiomorpha* sp. (twigs & crown)			s
?Maskellia sp. (twigs)			s
**Eriococcus coriaceus* (Mask.) (twigs & leaves)	p		s
**Opisthoscelis* sp. (twigs)		g	
EURYBRACHYIDAE			
Platybrachys decemmacula (Walk.) (twigs)			s
EURYMELIDAE			
Eurymela fenestrata L. & S. (twigs & stems)			s
Eurymeloides bicincta (Er.) (twigs & stems)	p		
E. pulchra Sign. (twigs & stems)			s
MEMBRACIDAE			
Acanthucus trispinifer Fairmaire (young twigs)		g	
PSEUDOCOCCIDAE (mealy-bugs)			
Monophlebulus pilosior (Mask.) (under bark)			s
Nodulicoccus nr. *levis* (Mask.) (on stems)	p	g	s
"Pseudococcus" casuarinae Mask. (under bark, stems)		g	s
Puto gisleni Oss.			s
Gen. et sp. indet. (under flocculence, stems)			s
PSYLLIDAE (jumping plant lice)			
(All except *Phellopsylla* attack foliage)			
**Cardiaspina fiscella* Taylor (see Taylor 1962)		g	s
C. maniformis Taylor		g	
Creiis corniculata (Frogg.)			s
**Glycaspis baileyi* Moore (see Moore 1961a, 1961b)			s
G. cyta Moore	p		
**G. granulata* (Frogg.)		g	s
G. hirsuta (Frogg.)	p		
G. seriata Moore	p		
**G. ?planitecta* Moore	p		
Spondyliaspis sp.			s
Phellopsylla ?formicosa Frogg. (under bark, stems)	p		s
Psylla sp. (severely curl young leaves)	p	g	s
RICANIIDAE			
**Scolypopa australis* Walk. (foliage & twigs)		g	

HYMENOPTERA

CHALCIDOIDEA			
? (in gall-forming complex, twigs)			s
EURYTOMIDAE			
? (in gall-forming complex, twigs)			s
PERGIDAE (saw-flies)			
**Perga dorsalis* Leach (foliage)		g	
**Pergagrapta hackeri* Benson (see Benson 1940) (foliage)		g	
P. polita Leach (foliage)		g	
**Polyclonus atratus* Kirby (see Moore 1957) (foliage on ground)		g	s
TENTHREDINIDAE (saw-flies)			
**Phylacteophaga froggatti* Rick (miner in foliage)		g	s
**Pterygophorus* sp.	p		
TORYMIDAE			
Epimegastigmus sp. (in gall-forming complex)		g	
Megastigmus maritimus Grlt.			s

ISOPTERA

RHINOTERMITIDAE			
**Coptotermes acinaciformis* (Frogg.)	p		
**C. frenchi* Hill	p		
**C. lacteus* (Frogg.)	p		s
**Schedorhinotermes intermedius* (Hill)			s

LEPIDOPTERA

COSSIDAE			
Xyleutes magnifica Roths.			s

A number of species of the family Cossidae damage the stems of small or large trees of *Eucalyptus* spp., and *X. magnifica* is apparently the largest of these species. The damage caused by their larvae (Fig. 1) has been found in stems of large trees of *E. saligna* from 1′ to 6′ above ground-level.

Near the base of the damaged area, a small round hole about 10 mm. to 15 mm. in diameter through the bark, is kept covered with webbing, excreta and pieces of wood and bark, by the larva. A red staining of the bark occurs downwards from the lower edge of the hole. Externally, the bark surface appears to be intact until the larva is almost ready to pupate, but before pupation, most of the bark covering the damaged sapwood is removed by the larva.

By the time the larva has reached a late stage of development, an elongate exit hole somewhat like a large keyhole, leads inwards from the sapwood to the round larval tunnel which extends upwards for about 10″ in the true-wood. An extensive and irregular area of the surrounding sapwood is also excavated, and the surface of this area is blackened and covered with a moist, slimy substance, prior to removal of the outer bark by the larva.

After pupation, the pupa appears to remain at the upper extremity of the round tunnel, facing downwards.

A considerable quantity of a fine, white mealy substance occurs externally on the pupa, and also on the adult specimen after it has emerged. A pupa, cut from the damaged area on a large tree of *E. saligna* on 19 November, emerged as an adult on 28 November.

ELACHISTIDAE or YPONOMEUTIDAE			
?	p	g	s

(This species has been called the "sinuate borer", because of the typical damage of larvae in the sapwood of living trees).

During this project, no adults of this species were reared, even though the species is widespread, and of common occurrence on a number of host

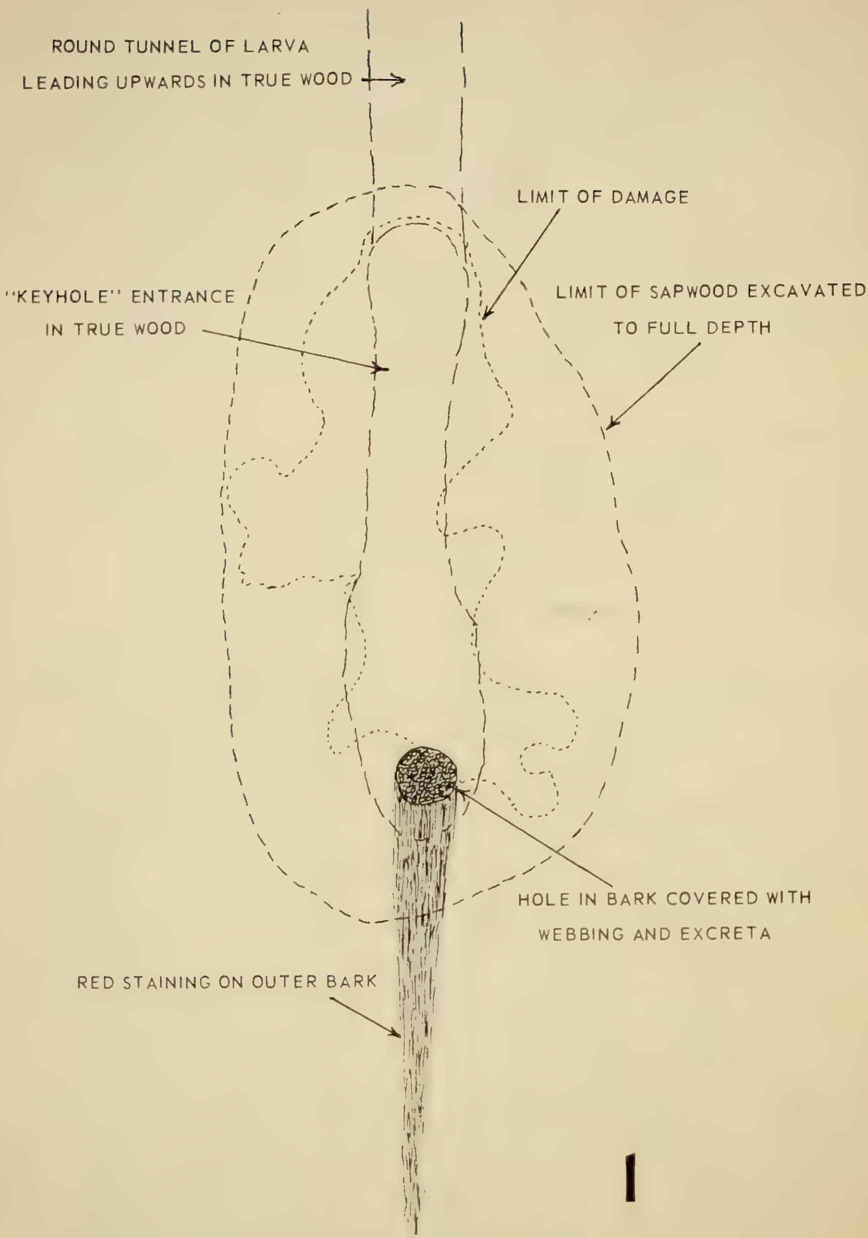


Figure 1.—Damage of larva of *Xyleutes magnifica* Roths. to stem of a large tree of *Eucalyptus saligna* Smith.

eucalypts. Until adults are obtained, an identification of the species cannot be given, but some of its biology is recorded here.

Almost all *Eucalyptus* spp. occurring in the eastern highlands and coastal areas of New South Wales appear to be attacked, presumably by the one species of borer, and *Angophora floribunda* is also its host.

Some of the habits of this species were determined from numerous trees of various ages, felled during several months.

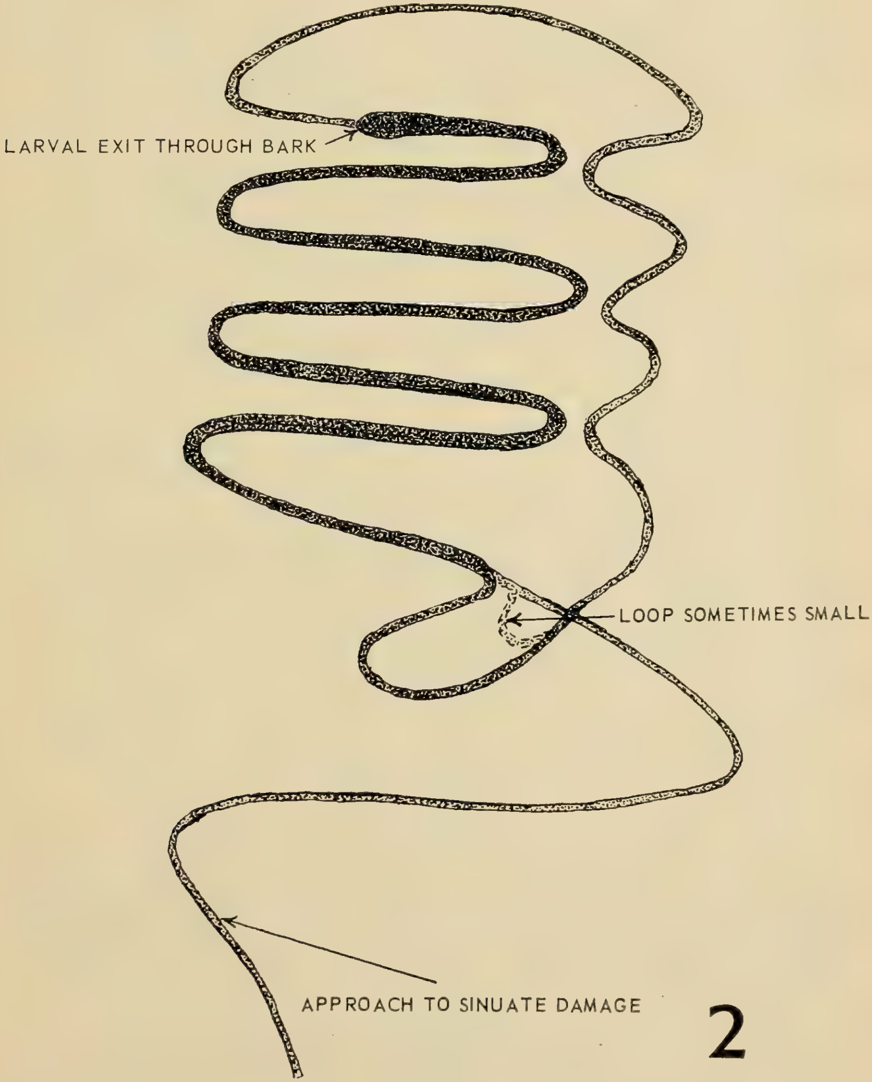


Figure 2.—Damage of larva of "sinuate borer" to the sapwood of a tree of *Eucalyptus saligna* Smith.

Oviposition by the adults, which apparently frequent the tree-crown area, occurs in the smaller twigs of about 6 mm. to 8 mm. in diameter, during the months of October to December, and by late March, some larval workings may reach to ground-level. Larval channels may thus exceed 70 feet in length, before the sinuate damage, typical of the late instar larvae, is formed.

Larvae of early instars superficially resemble nematodes. After being almost colourless during early instars and creamy-white during later instars, larvae eventually become dark grey in colour. Last instar larvae may attain a length of about 20 mm. prior to their emergence through the bark to pupate. An orange coloured dorso-lateral mark occurs each side of abdominal segment 5 on some larvae. Early instar larvae possess a flattened head-capsule similar to some leaf-miners of the family Gracilariidae (see Moore 1963), but the head capsules of late instar larvae are more rounded and similar in shape to those of most typical lepidopterous larvae.

Until the late instars, larvae tunnel below the surface cells of the outer layer of the sapwood, and are apparently continuously surrounded by the moisture which is translocated to the crown from the root system.

The tunnelling of the early instars is nearly always visible as a thin, pale brown line immediately below the tissues of the sapwood surface, when bark is removed. The tunnelling is sometimes in a more or less straight line, but at times it may become tortuous. From the twigs of the tree-crowns, larvae have been traced to ground-level before they turn upward again to construct the typical sinuate damage of the late instar larvae. Areas of sinuate damage (Fig. 2) have occurred at heights varying from 3′ to 25′ above ground-level. This type of damage is produced only by the last or penultimate instar larvae.

The sinuate damage is commenced as the larva channels upward, and may be commenced from a "left hand" or a "right hand" approach. It appears to be dependent on the "left hand" or "right hand" approach to the initial construction of the sinuate portion, as to which side of the sinuate portion the larva eventually proceeds downwards, on completion of that portion. The original approach channel to the sinuate area is then located and crossed by the larva. In each instance observed, the approach channel is first crossed, and then re-entered, before the larva proceeds to enlarge the sinuate portion further. The sinuate channel then becomes packed with coarse, dark excreta, and the inner tissues of the bark are also excavated, so that the outer bark surface of smooth-barked trees eventually bears the mark of the sinuate portion of damage constructed some years previously. The shape of the sinuate portion is more or less constant, irrespective of the tree-species on which it occurs.

During the enlarging of the sinuate channel, larvae emerge through a narrow vertical slot cut through the bark at a location above the lower half of the sinuate portion. The bark surrounding the slot, later turns brown in colour.

No correlation of the sinuate area with bark thickness, height above ground-level, or any particular segment of the tree stem was made.

On a tree 50′ in height and 11″ diameter-at-breast-height, a larva emerging through the bark during September, was obtained, and several other specimens had commenced the "repeat" tunnelling and enlarging of the sinuate area. The larva was placed in a glass jar containing soil and debris, together with a piece of sapwood leaning at an angle from the base to the top of the jar. The larva continually moved around in the jar, and granules of the sandy soil readily adhered to it, until it became almost immobilised.

When it was evident that the adherence of the soil was detrimental to the larva, the soil was removed from it with a sable-hair brush. The soil and debris were also removed from the jar and replaced with a large piece of smooth, fresh bark of *E. saligna*. The larva then commenced to construct its cocoon on the bark surface, but the elongate, greyish cocoon was not completed before the larva died.

From these observations it may be inferred that larvae avoid contact with soil, and possibly move upward from the emergence slot through the bark of the stem, towards the tree-crown area to pupate.

Sacking bands were attached at various heights to three trees, but no larvae pupated in them.

Attack has been correlated with trees of *E. saligna* severely damaged by fire some 8 years previous to the attack studied, and to plantations of *E. grandis* growing beyond the areas of its natural occurrence.

EUPTEROTIDAE			
**Panacela lewinae* Lewin (see Moore 1963b) (foliage)	p	g	s
GELECHIIDAE			
Protolechia chalazodes Turner (leaf-tier)			s
**P. mesochra* (Lower) (leaf-tier)	p	g	s
Protolechia sp. (leaf-tier)		g	
GEOMETRIDAE			
**Ectropis rufibrunnea* Warren (foliage)		g	
**Lophodes sinistraria* Guen. (foliage)			s
**Mnesampela privata* Guen. (foliage)	p	g	s
**Pingasa bryophylla* Goldfinch (foliage)	p	g	
Poecilasthena thalassius Meyr. (foliage)		g	
GRACILARIIDAE			
**Acrocercops calicella* (Stainton) (see Moore 1966a) (leaf-miner)			s
A. hoplocala (Meyr.) (leaf-miner)			s
**A. laciniella* (Meyr.) (leaf-miner)	p		s
**Parectopa ida* (Meyr.) (leaf-miner)			s
HELIOZELIDAE			
**Heliozela prodela* Meyr. (leaf-miner)	p	g	s
HEPIALIDAE			
**Aenetus eximius* (Scott) (stem borer)	p	g	
**A. lignivorus* (Lew.) (stem borer)		g	
Perissectis australasiae Don. (roots of young plants)		g	
Zelotypia stacyi Scott (stem borer)		g	s
Gen. et sp. indet. (in stems of large trees)			s
INCURVARIIDAE			
**"Tinea" nectarea* Meyr. (leaf-miner)	p	g	s
"Tinea" sp. (*spodina* group) (leaf-miner)			s
**"Tinea"* sp. nr. *spodina* (leaf-miner)	p		s
LASIOCAMPIDAE			
**Entometa fervens* Walk. (foliage)			s
LIMACODIDAE			
Anapaea trigona Turn. (foliage of large trees)			s
**Doratifera casta* Scott (foliage)	p		s
D. oxleyi Newm. (foliage)			s
**D. quadriguttata* (Walk.) (foliage)	p		s
**D. vulnerans* (Lewin) (foliage)	p	g	s
LYMANTRIIDAE			
**Axiologa pura* Lucas (foliage)	p		s
LYONETIIDAE			
**Hieroxestis omoscopa* Meyr. (see Moore 1959) (fallen) leaves)		g	
NEPTICULIDAE			
**Nepticula* sp. No. 1 (leaf-miner)		g	s
**Nepticula* sp. No. 2 (leaf-miner)	p	g	s
**Nepticula* sp. No. 3 (leaf-miner)	p		s
**Nepticula* sp. No. 4 (leaf-miner)	p		s
**Nepticula* sp. No. 5 (leaf-miner)	p		
NOLIDAE			
**Uraba lugens* Walk. (see Campbell 1962) (foliage)		g	

OECOPHORIDAE			
**Barea banausa* (Meyr.) (see Moore 1959) (rotting wood)			s
**B. confusella* (Walk.) (rotting wood)	p		
**B. consignatella* Walk. (rotting wood)			s
**B. turbatella* (Walk.) (rotting wood)			s
**Eupselia* nr. *carpocapsella* Walk. (leaf-miner)	p		s
Notodryas aeria Meyr. (leaf-tier)	p		
PSYCHIDAE			
**Clania ignobilis* (Walk.) (foliage)	p		
**Hyalarcta huebneri* (Westw.) (see Moore 1963c) (foliage)	p		s
**H. nigrescens* (Doubl.) (foliage)	p		
**Narycia* sp. (foliage)	p		
**Trigonocyttara clandestina* Turn.	p		s
SATURNIIDAE			
**Antheraea eucalypti* Scott (foliage)	p		
SPHINGIDAE			
Metamimas australasiae Don. (foliage)			s
TINEIDAE			
Tinea diaphora Meyr. (under bark)			s
TORTRICIDAE			
Acroclita nr. *perspectana* Walk. (associated with stem-galls)			s
Acropolitis hedista (Turn.) (foliage)	p		
**Cryptoptila immersana* (Walk.) (foliage)		g	
Eboda exeristis Meyr. (see Common 1965) (leaf-tier)		g	
**Epiphyas xylodes* (Meyr.) (leaf-tier)	p	g	
**Isotenes miserana* (Walk.) (foliage)	p	g	
Spilonota macropetana Meyr. (foliage)	p		
Thrincophora tetrica Turn. (foliage)	p		
XYLORYCTIDAE			
Cryptophasa balteata (Walk.) (stem borer)			s
Illidgea epigramma Meyr. (stem borer)			s
Gen. et sp. indet. (stem borer)		g	

ORTHOPTERA

PHASMATIDAE			
**Extatosoma tiaratum* (Macl.) (foliage)	p		
TETTIGONIIDAE			
**Caedicia congrua* (Walk.) (foliage)	p		
Paragryllacris ?combusta Germ. (Predatory on large larvae of wood borers)	p	g	s

THYSANOPTERA

THRIPIDAE			
**Australothrips bicolor* Bagnall (foliage)			s

During these observations, a phytophagous fungus was found to attack the leaves of young plants, and the species was identified as:-

Botrytis sp. g

It was also determined that wallabies ate the young growing tips of small plants, and broke many stems. Damage appeared to be most severe in open areas, where the plants were not competing with weeds and other growth. It appeared that seedlings among the cover of other plants were masked from such heavy attack.

ACKNOWLEDGEMENTS

Identifications of the insects referred to in this paper were made by staff of:- The Australian Museum, Sydney; The British Museum, (Nat. Hist.), London; C.S.I.R.O., Canberra; Department of Primary Industries, Brisbane, Queensland; The Waite Agricultural Research Institute, Adelaide, South Australia; and Dr. J. W. Evans of Sydney and Dr. Karl Schedl of Austria.

REFERENCES

Benson, R. B., 1940.—A Revision of the Australian Sawflies of the Genus *Perga* Leach *sens. lat. Hymenoptera*: Symphyta, *Aust. Zool., 9*:324-357.

Campbell, K. G., 1962.—The Biology of *Roeselia lugens* (Walk.), the Gum-leaf Skeletonizer Moth, with Particular Reference to the *Eucalyptus camaldulensis* Dehn. (River Red Gum) Forests of the Murray Valley Region. *Proc. Linn. Soc. N.S.W., 87*(3):316-338.

Common, I. F. B., 1965.—A Revision of the Australian Tortricini, Schoenotenini, and Chlidanotini (Lepidoptera: Tortricidae: Tortricinae). *Aust. J. Zool., 13*:613-726.

Duffy, E. A. J., 1963.—A Monograph of the Immature Stages of Australian Timber Beetles (Cerambycidae). Trustees, British Museum, London.

Hurditch, W. E., 1968.—Raising Blackbutt Seedlings on the North Coast. *Forest & Timber, 5*(3):8-9 (March).

Moore, K. M., 1957.—Notes on the Biology of the Sawfly *Polyclonus atratus* Kirby 1882 (Family Pergidae, Subfamily Euryinae), and Some of its Parasites. *Proc. Roy. Zool. Soc. N.S.W.*, pp. 74-81.

——— (1959).—The Biology and Larval Taxonomy of Some Lepidoptera Attacking Trees and Timber. *Aust. Zool., 12*(4):337-350.

——— 1961.—Insects Associated With *Eucalyptus saligna, E. acmenioides* and *Angophora intermedia. Proc. Roy. Zool. Soc. N.S.W.*, pp. 87-95.

——— 1961a.—The Significance of the *Glycaspis* spp. (Hemiptera: Homoptera, Psyllidae) Associations With Their *Eucalyptus* spp. Hosts; Erection of a New Subgenus and Descriptions of Thirty-eight New Species of *Glycaspis. Proc. Linn. Soc. N.S.W., 86*(1):128-167.

——— 1961b.—The Biology and Occurrence of *Glycaspis baileyi* Moore in New South Wales. *Proc. Linn. Soc. N.S.W., 86*(2):185-200.

——— 1963.—Two Species of Lepidopterous Leafminers Attacking *Eucalyptus pilularis* Smith. *Aust. Zool., 13*(1):46-53.

——— 1963a.—Some Mortality Factors of *Phoracantha semipunctata* (F.) (Coleoptera: Cerambycidae). *Proc. Linn. Soc. N.S.W., 88*(2): 221-229.

——— 1963b.—An Indigenous Insect, *Panacela lewinae* (Lewin) (Lepidoptera: Eupterotidae) Attacking Exotic *Pinus* spp. in New South Wales. *Aust. Zool., 13*(1):40-45.

——— 1963c.—Lepidoptera Attacking *Pinus* spp. in New South Wales. *Proc. Linn. Soc. N.S.W., 88*(3):340-360.

——— 1966.—*Hesthesis cingulata* (Kirby) (Coleoptera: Cerambycidae) Attacking Young Plants of *Eucalyptus pilularis* Smith. *Aust. Zool., 13*(3):299-301.

——— 1966a.—Notes on Some Australian Leaf-miners. *Aust. Zool., 13*(4): 303-349.

Taylor, K. L., 1962.—The Australian Genera *Cardiaspina* Crawford and *Hyalinaspis* Taylor (Homoptera: Psyllidae). *Aust. J. Zool., 10*(2): 307-348.

OBSERVATIONS ON SOME AUSTRALIAN FOREST INSECTS

27. SOME INSECTS ATTACKING *CALLITRIS HUGELII* (WHITE CYPRESS PINE).

by K. M. MOORE
Forestry Commission of New South Wales.

(Plates III-IV; figs. 1-3)

SUMMARY

Some information on sixteen insect species known to utilise *Callitris hugelii* (Carr.) as their host, is given.

INTRODUCTION

Natural stands of the indigenous *Callitris hugelii* in the Western Districts of New South Wales constitute the most extensive areas and plentiful source of potential softwood supply available to sawmills in that State. Those areas in State Forests are managed to obtain the best possible utilisation of the timber and the perpetuation of this pine species.

The incidence of large populations of the sawfly *Zenarge turneri rabus* Moore attacking large trees, and regeneration of *C. hugelii* were studied during entomological investigations over a number of years, and during that time, attack by a number of other insect species also became prevalent.

Froggatt (1921, 1923, 1927) has recorded information on some of the species dealt with in this paper, and observations recorded here add to knowledge concerning the habits of the species, some of which do not appear to have been recorded previously.

COLEOPTERA

APIONIDAE

Apion meridionale Lea

This species of weevil was first described by Lea (1910) as *Apion cylindrirostre,* but as the name was later found to be preoccupied, he altered it to *A. meridionale* during 1926.

A specimen labelled "Co-type", in the Macleay Museum, University of Sydney, was examined, and some twenty specimens of *A. meridionale* were reared by the writer during 1961-1962.

The galls formed by *A. meridionale* occur at the tips of the foliage (Plate III, fig. A), and for some time remain the same colour as the foliage, later becoming pale orange in colour. During the months of October and November they fracture at their base from the remainder of the foliage, and fall to the ground. The bright orange larvae then protrude from the basal end of the fully formed gall which is about 4 mm. in length, and vigorously pull it among the debris on the ground. After lodging their gall cases in a potentially sheltered situation near the tree from which they have fallen, the basal opening is sealed with a mixture of fine silken webbing and excreta, after which the larva reverses its position to face the distal end of the gall case. Larvae then remain in these cases, and adults emerge from the distal ends of the cases during the following March to May, although a few larvae remain in their cases for an additional undetermined period of time.

Widespread and severe attack on *Callitris hugelii* can occur from March to May, during which time adults may be found copulating and ovipositing in the foliage. Adults also feed on the foliage during those months, and many leading shoots on young regeneration wither and die as a result of their feeding. Regeneration of all ages and heights, and large trees, may be attacked, and the foliage of extensively damaged trees becomes shaggy in appearance.

Adults of *A. meridionale* are from 2 mm. to 2.5 mm. in length. The head bears some white scales, and the scales on the pronotum are deep golden-fawn in colour. The elytra bear thick whitish scales on the basal portion to about half of their length, with the remainder of the same colour as the pronotum except that the centre of the distal half of each elytron is darker golden brown. The striations formed by white scales are distinct. Adults bear white scales ventrally and on their pale red-brown legs. The rostrum is dark red-brown, shiny, and almost straight, and the dark red-brown antennae bear a few white scales on the club.

Apion australasiae Lea

Remarkable foliage galls are caused by larvae of this species of weevil, and their shape (Text-fig. 1) is quite distinctive when compared with those caused by larvae of *A. meridionale.* Because of the peculiar formation of these galls at the distal tips of foliage, they are referred to here as "pineapple-top" galls.

The fully formed galls are about 7 mm. in length, and remain the same green colour as the foliage. Large numbers of these galls apparently do not occur at the one time. They are quite similar in shape, and may be mistaken for, another type of gall formed by a dipterous species of the family Cecidomyiidae. On close examination they may be separated from the latter galls by (a) their more elongate structure; (b) the less compact arrangement of the "leaves", the tips of which are more noticeably curled outwards; (c) the placement of the single gall in the central tissues of the shoot.

The times when the various stages of *A. australasiae* may occur have not been fully investigated, but small larvae have been found in galls during November, and both the pupal and early adult stages have been collected

Figure 1.—"Pineapple-top" gall of *Apion australasiae.*

during October. Adults are present on foliage during June, so that the general biology of the species may be similar to that of *A. meridionale*.

Adults of *A. australasiae* are about 2.5 mm. in length. The whitish scales on the elytra are lightly suffused fawn, and the straight rostrum is slightly shorter than the pronotum. Ventral scales are white, and the antennae are red-brown in colour.

Species of chalcidoid wasps parasitise larvae of *A. australasiae,* and specimens have emerged during March.

Apion ? pudicum Lea

This is another gall-forming species, the galls of which are woody and formed on the branchlets of young regeneration, usually at the junctions with lateral shoots (Plate IV). Larval stages are present in the galls during March to May, and pupae during June and July.

Prior to pupation, larvae cut a recess in the inner woody gall tissues almost to the inner bark area, probably to allow ready emergence of the adults from the galls.

Figure 2.—Gall of cecidomyiid, genus near *Dishormomyia.*

Figure 3.—"Pineapple-top" gall of cecidomyiid, genus near *Dishormomyia.*

Several adult specimens were reared from galls collected during June and July, from Yarrigan and Euligal State Forests (Baradine District), by M. J. Gardner, at that time the District Forester. Adults emerged during August.

Adults are from 2.5 mm. to 2.75 mm. in length. White scales on the black cuticle cause specimens to appear greyish in colour, and those on the elytra show distinct striations. Scales are more sparse on this species than on *A. meridionale* or *A. australasiae.* The distinctly curved rostrum is black and shiny, and about as long as the pronotum. The antennae are dark red to black.

BUPRESTIDAE

Diadoxus erythrurus (White) and *D. scalaris* L. & G.

Some information, principally concerning the first species, is recorded by Hadlington & Gardner (1959).

For a clear interpretation of the taxonomy of the two species, more detailed studies, particularly of the biology and morphology of their larvae, are necessary.

On present knowledge concerning the habits of the two species, it appears that larval populations of both species intermingle, and compete for existence at the overlapping extremes of their biological niches in the cambium-phloem region of either large, debilitated trees, or plants of regeneration under stress. However, larvae of *D. scalaris* generally utilise the lowest portion of a stem, and the root system, while larvae of *D. erythrurus* generally utilise the upper portion and limbs of a tree. In young regeneration, adults of either species have been found associated with the death of plants, but the workings of *D. scalaris* appear to extend into the root system whereas those of *D. erythrurus* appear to be confined to that portion of the stem occurring above ground-level.

An examination of slide preparations of larval exuviae, and particularly of the spiracle morphology, may show characteristics on which larvae of the two species might be identified.

CERAMBYCIDAE

Uracanthus pallens Hope

Subsequent to a series of seasons with above-average rainfall in western areas of New South Wales, exceptionally plentiful regeneration of *C. hugelii* apparently provided conditions suitable for extensive attack and a large increase in the population of *U. pallens.*

Where competition between young plants was severe, or where excessive regeneration occurred in areas less suitable for the young plants, numerous dead and dying tops of young plants up to 5 feet in height were found. The approximate upper half of attacked plants became brown or red-brown in colour, and died, so that when lateral pressure was applied to the upper portions of these plants, the stems would readily fracture immediately above the living, green portion of the lower stem.

Attack occurs throughout the areas where *C. hugelii* is distributed, from Baradine to Narrandera.

Adults oviposit in the leading shoot of a young plant. On eclosion, the young larva works downwards in the phloem-cambium region to about half of the distance to ground level, where a deeply recessed girdling of the plant stem occurs and extends considerably into the woody tissues. It is in this more extensively damaged area that plants readily snap across the plane of weakness. The tops of plants, which break off soon after girdling by the larva occurs, contain the immature larvae which continue to channel through the central portion of the detached plant-top, and towards the leading shoot where oviposition originally occurred. Larvae may also penetrate extensively along the centres of small lateral branchlets, where holes through the outer bark may connect with the central larval channel and sometimes with extensive channelling just below the bark.

There is apparently a single generation of this species each year, larvae occurring from early spring until the following autumn, so that a considerable

overlap within the single generation is apparent. Adults emerge during the warmer months.

The larvae, bearing chitinised spines posteriorly, are figured by Duffy (1963).

Bethelium tillides (Pascoe)

This species attacks regeneration of about 3 to 8 years of age, in that portion of the stem which is about ¾" in diameter, and downwards to within about 3" of ground level.

Larvae work in channels under the bark only, but before pupating, they cut a pupal chamber which is at first horizontal and towards the centre of the stem for a short distance, then abruptly curved downwards.

The duration of the life-cycle of *B. tillides* is from one to two years, and adults emerge during the months of March to May.

DIPTERA

CECIDOMYIIDAE

Larvae form the segmented, spherical, orange-coloured galls on the tips of the foliage (Plate III, fig. B), and the species is referred to by Froggatt (1923) as *Diplosis frenelae*.

The orange-coloured larvae and pupae are located within the hollow galls until the month of October, when the adults then emerge.

Galls are most numerous during early spring, although it appears that a few large galls of a subsequent generation are present during early autumn.

Genus near *Dishormomyia*

Specimens were identified at the British Museum during 1962.

The 3-segmented elongate galls formed by larvae of this species (Text-fig. 2) occur on the tips of the foliage, and are usually in smaller numbers than the previous species. At first, they are of the same green colour as the foliage, later attaining a length of about 8 mm. and becoming reddish-purple or yellow to orange in colour during May, June, October or November. Adults have emerged during the latter month, and the incidence of galls suggests that two generations occur during the year.

Genus near *Dishormomyia*

Adults of this species were also examined at the British Museum during 1962.

Galls, which occur in the tips of foliage, and result from attack by larvae of this species (Text-fig. 3), are similar in shape and size to those of *Apion australasiae*. Because of their peculiar shape, they might also be referred to as "pineapple-top" galls. However, they are shorter, and of greater diameter than the galls of *A. australasiae;* the tips of the gall "leaves" are almost straight, rather than outwardly curled as are those of *A. australasiae,* and these "leaves" are also fewer in number. The cecidomyiid galls occur within, and towards the bases of, the leaves, instead of in the central tissues of the shoot. Within each galled "pineapple-top", 3 to 6 larval galls may occur, each gall containing a single larva, and each being formed towards the base of a separate leaf.

HEMIPTERA

COCCOIDEA

Gen. et sp. indet.

Adult specimens have not been reared from the galls of this species, and there is uncertainty as to which family they belong.

Advanced galls may be very numerous in twigs of the lower branches of some large trees during October, and the foliage of severely affected branches becomes sparse and of a dull green colour.

The small, hard galls are grey in colour and have an uneven surface. Although the outer tissues may appear dead, the hard, woody inner gall tissues are living, and the gall cavity is completely filled by those insects at an advanced stage of development.

There appears to be a complex of other insect species associated with these galls.

LACCIFERIDAE

Tachardia (or *?Austrotachardia*) *decorella* Maskell

This species is figured by Froggatt (1921b). Heavy infestations of this scale may cover the stem and proximal ends of branches of young regeneration up to 10 feet in height, and the plants are usually covered with "sooty mould" fungus.

PSEUDOCOCCIDAE

Dysmicoccus sp. nov.

It is more usual to find occasional scattered specimens of this species on the stems and small branches of young regeneration, although at times a large population may occur on the one plant, during most months of the year.

Specimens were identified by Miss Helen Brookes, of the Waite Agricultural Research Institute, South Australia.

The syrphid *Xanthogramma grandicornis* Macq. is a predator of this species.

APHIDIDAE

Cinara (*Cupressobium*) *tujafilina* (Del Guercio)

This species of aphid (see Eastop 1966) at times may occur in large numbers on young regeneration. Other Australian *Callitris* spp., and other host plants, are also attacked by this species.

Specimens were identified by Dr. V. F. Eastop, of the British Museum.

When a large population occurs on a plant, the black fungus "sooty mould", which develops on the aphid "honeydew", may cover the whole plant.

LEPIDOPTERA

TORTRICIDAE

Tracholena homopolia Turner

Larvae of this species attack and destroy the unripened seeds in the partly matured cones of *C. hugelii*. Some, or all of the seeds in the cones may be either damaged or totally destroyed by larvae.

An adult specimen, which emerged during December, was reared from seed capsules obtained from the Narrabri area, and was identified by Dr. I. F. B. Common who has recorded some information (1965) concerning the species in the genus *Tracholena*. Apparently, the habits of this species were previously unknown.

HYMENOPTERA

ARGIDAE

Zenarge turneri rabus Moore

Large populations of this sawfly may occur on both large trees and regeneration, growing under stress. The taxonomy and biology of the two sawfly subspecies have been recorded (Moore 1962a, 1962b).

CONCLUSION

Specimens of the species referred to in this paper are in the collection of the Forestry Commission of New South Wales.

ACKNOWLEDGEMENTS

The writer is most grateful to those referred to in the text of this paper, who identified the insect specimens.

REFERENCES

Common, I. F. B., 1965.—A Revision of the Australian Tortricini, Schoenotini, and Chlidanotini (Lepidoptera: Tortricidae: Tortricinae). *Aust. J. Zool., 13*:613-726.

Duffy, E. A. J., 1963.—A Monograph of the Immature Stages of Australasian Timber Beetles. Trustees, British Museum, London.

Eastop, V. F., 1966.—A Taxonomic Study of Australian Aphidoidea (Homoptera). *Aust. J. Zool., 14*:399-592.

Froggatt, W. W., 1921a.—A Descriptive Catalogue of the Scale Insects (Coccidae) of Australia II. Government Printer, Sydney.

——— 1921b.—*ibid.* Part III.

——— 1923.—Forest Insects of Australia. Forestry Commissioners, N.S.W.

——— 1927.—Forest Insects and Timber Borers. Forestry Commissioners, N.S.W.

Hadlington, P. & Gardner, M. J., 1959.—*Diadoxus erythrurus* (White) Coleoptera: Buprestidae, Attack of Fire-damaged *Callitris* spp.". *Proc. Linn. Soc. N.S.W., 84*(3):325-331.

Lea, A. M., 1910.—Notes on Australian Curculionidae in the Collection of the German Entomological National Museum of Berlin. *Deutsch. Ent. Zeitschr.,* (5):514-5.

——— 1926.—On Some Australian Curculionidae. *Proc. Linn. Soc. N.S.W., 51*(3):340-350.

Moore, K. M., 1962a.—The Taxonomy of *Zenarge turneri* Rohwer (1918) (Hymenoptera: Argidae), the Cypress Pine Sawfly. *Proc. Linn. Soc. N.S.W., 87*(2):116-124.

——— 1962b.—A Comparison of the Biology of the Cypress Pine Sawfly Subspecies. *ibid., 87*(2):125-136.

OBSERVATIONS ON SOME AUSTRALIAN FOREST INSECTS

28. INSECTS ATTACKING *LANTANA CAMARA* L. IN NEW SOUTH WALES.

by K. M. MOORE
Forestry Commission of New South Wales

INTRODUCTION

The possible biological control of *Lantana camara* in State Forests of New South Wales has been of interest to the Forestry Commission of that State for some years.

During preliminary considerations of the possibility of controlling this exotic plant species with insects, a limited survey of those species then attacking plants growing in the Central Coast areas of the State was made, to determine the extent of damage in that area by the species concerned.

The thirty-three species listed below were observed to feed on *L. camara,* but these observations should be regarded as preliminary only, because of the liimted time available for this study. None of the species appeared to exert any degree of visible control of the host plants on the Central Coast.

Wilson (1960) gives some inforation on those exotic insect species previously introduced to Australia to be released on *Lantana* spp.

DIPTERA

AGROMYZIDAE

Ophiomyia lantanae (Frogg.)

This species mines in the pith surrounding the seeds of *Lantana* spp., and sometimes enters and destroys the seed.

HEMIPTERA

ALEYRODIDAE

?*Trialeurodes vaporariorum* Westw.

Large numbers of nymphs at times occur on leaves, particularly when plants are growing in shaded or damp situations.

APHIDIDAE

Aphis gossypii Glov.

The tender new growth of plants is attacked by this species.

APHROPHORIDAE

Philagra concolor Hacker

Damage by the few specimens observed, appears negligible.

CICADELLIDAE

Vulturnus vaedulcis Kirkaldy
&
Orosius argentatus (Evans)

CIXIIDAE

Leptolamia spp. (2 spp.)
&
Gen. et sp. indet.

ACHILIDAE

Phenelia elidipteroides Kirk.
&
Gen. et spp. indet. (2 spp.)

DERBIDAE

Levu sp.
Oecenchrea montistympani Jacobi
Saccharodite sp.
Swezeyia sp.

ISSIDAE

Gen. et sp. indet.

MIRIDAE

Gen. et sp. indet.

PENTATOMIDAE

Antestiopsis cedarwaldi Bergr.
Morna sp.

NOGODINIDAE

Salona chrysopoides (Walk.)

RICANIIDAE

Scolypopa australis Walk.

Large numbers of this species have occurred on a number of plants in a discrete area.

LEPIDOPTERA

GEOMETRIDAE

Pingasa bryophylla (Goldfinch)

HEPIALIDAE

Aenetus lignivorus (Lewin)

LYMANTRIIDAE

Porthesia paradoxa Bh.

NOCTUIDAE

Plusia argentifera Guen.
Plusia chalcites (Esper.)

TORTRICIDAE

Cryptoptila immersana (Walk.)
Epiphyas postvittana (Walk.)
Epiphyas xylodes (Meyr.)
Isotenes miserana (Walk.)

XYLORYCTIDAE

Gen. et sp. indet.

ORTHOPTERA

TETTIGONIIDAE

Caedicia sp.

Specimens of the species recorded in this paper are in the collection of the Forestry Commission of N.S.W.

ACKNOWLEDGEMENTS

The writer is grateful to Dr. I. F. B. Common for the identifications of the Lepidoptera; and to staff of The British Museum (Natural History), and The Australian Museum, for identifications of the Hemiptera.

REFERENCES

Wilson, F., 1960.—A Review of the Biological Control of Insects and Weeds in Australia and Australian New Guinea. Commw. Agric. Bureau, Bucks., England.

OBSERVATIONS ON SOME AUSTRALIAN FOREST INSECTS

29. EFFECTS OF CLEAR-FELLING OF TREES ASSOCIATED WITH INSECT ATTACK

by K. M. MOORE
(Forestry Commission of New South Wales)
(Figure 1)

SUMMARY

From previous intensive investigations on the association of large insect populations with debilitated trees in discrete areas on State Forests, it was determined that a complex of factors contributed to the poor health of the trees growing in those areas.

The possible effects of clear-felling, and site-factors within and contiguous to the areas of debilitation, on the growth of the future timber crop, were examined.

Clear-felling greatly increased the growth rate of regeneration in areas where large trees were previously debilitated, while growth of large trees in contiguous areas of debilitation tended to remain in either a static or a regressive state.

The incidence of insect attack on regeneration in a clear-felled strip was greatly reduced.

INTRODUCTION

The widespread debilitation and deaths of several *Eucalyptus* species carrying large populations of *Glycaspis* spp. (Psyllidae: Homoptera) or lerp insects, throughout numerous areas on State Forests and private properties in coastal areas of New South Wales, together with some investigations into the problem, were previously recorded (Moore 1959).

An extensive area where tree debilitation was most severe and deaths of trees were most numerous, was situated at Palmdale (Ourimbah State Forest, Section 1, Compartment 3), between Gosford and Wyong on the Central Coast of New South Wales. It was in this area that intensive studies were made on the psyllid insects, *Glycaspis* spp., and on their association in large populations with several debilitated *Eucalyptus* spp. growing in a shallow top-soil overlying deep bands of clay (Moore 1961a, 1961b).

The insect-attacked area of debilitated trees extended for about 1.5 miles in a continuous band of about 9 to 12 chains in width, between the 200′ and 400′ contours and at a constant altitude of about 150′ to 200′ above the valley referred to on the Gosford-Norahville Military Sheet as "Left Hand Gully" (Figure 1).

INVESTIGATIONS

Continuous observations on the above area were made by the writer from 1953 to 1970, and as a number of possible factors, apart from insect attack, appeared to be involved in the debilitation of trees, an experiment to examine any effects that clear-felling of an affected area might have on the subsequent regeneration and apparent health of the future timber crop, was planned during 1962. The possibility that growth of trees was influenced by site factors, within and contiguous to the affected area, was also examined, and in the same areas, the effect on the incidence of attack by *Glycaspis* spp. on regeneration was observed.

During December, 1962, the writer, together with Mr. A. A. Monnox who at that time was the Forester of the Wyong Subdistrict (Newcastle District), examined the area to locate a site suitable for clear-felling which might yield indications concerning the aspects mentioned above.

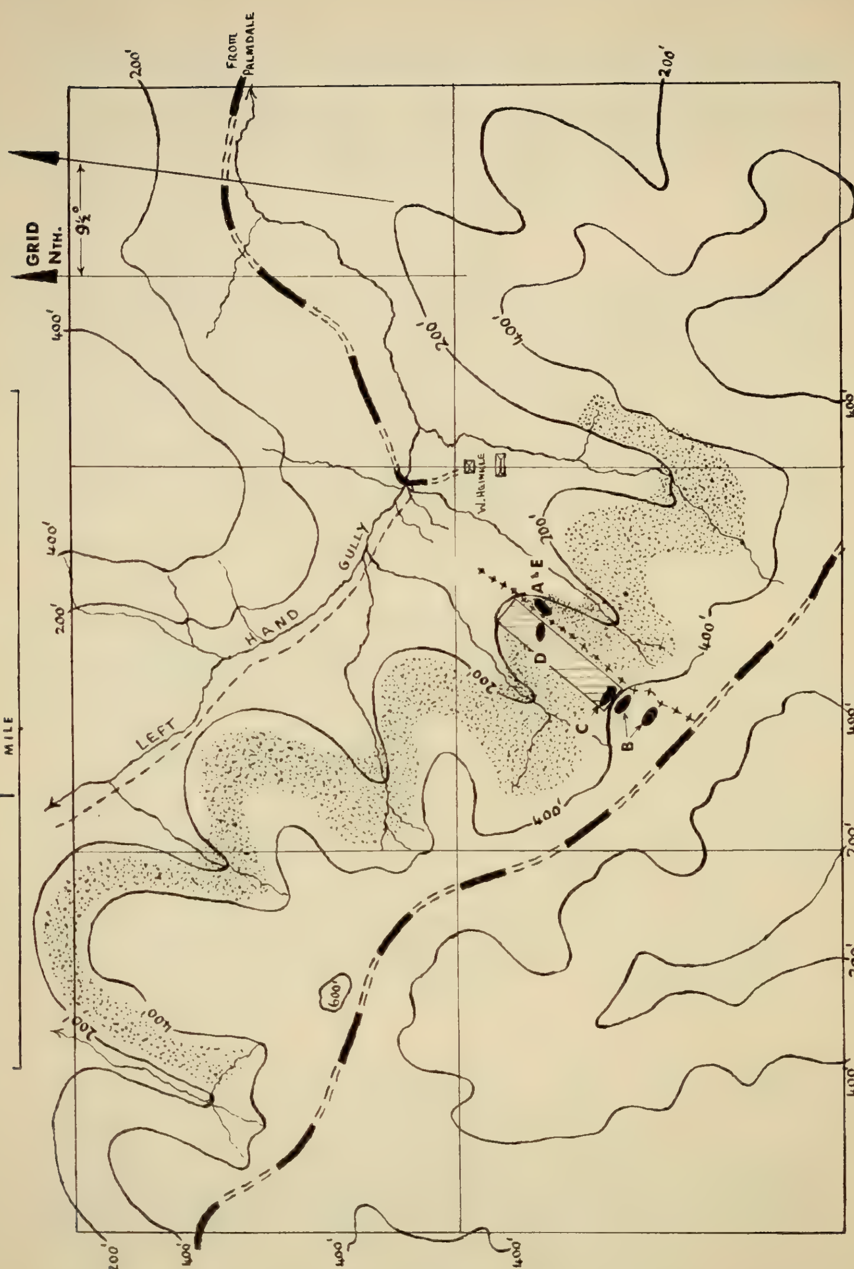


Figure 1.—Location of clear-felled strip through debilitated area (Ourimban State Forest, Section 1, Compartment 3), based on Gosford-Norahville Military Sheet.

The general purpose of the investigations was to examine the effects of clear-felling on the increment and general health of, and future incidence of insect attack on, an area of regeneration where large trees had, at least over the previous 12 years, been consistently and severely attacked by *Glycaspis* spp.

Numerous areas in New South Wales similarly affected by *Glycaspis* spp. were known where selective felling, or no felling, had been carried out, but none of these areas was known to have been clear-felled previously.

A rectangular strip of forest about 4.3 acres in area and having a width of about 3 chains and a length of about 15 chains, was selected for clear-felling. This strip was oriented with the slope of the hill, passing through, and extending above and below the debilitated area for about 3 chains in each direction. These 3-chain extremities of the clear-felled strip were regarded as control areas for comparison with any effects within the debilitated area.

The timber stand prior to felling, consisted of hardwood species with a maximum height of 100 feet, and its principal composition was in the approximate proportions of:- *Eucalyptus acmenioides* and *E. umbra* (white mahoganies) 40%; *E. paniculata* (grey ironbark) 30%; *E. deanei* (round leaf gum) 15%; *E. saligna* (Sydney blue gum) 5%; *E. resinifera* (red mahogany) 5%, and *Angophora floribunda* (rough barked apple) 5%. The varied ground cover consisted of hardwood regeneration, and herbage which had become established subsequent to selective logging of the area some 5 years previously.

The strip selected to be clear-felled had a slope varying from 7° to 25° with a general aspect facing to the north-east, and about one quarter of the ground-surface area, near the centre of the strip, consisted of a steep, stony and rocky formation.

All hardwoods exceeding 10 feet in height were felled, and an attempt was made to obviate damage to regeneration. The strip was clear-felled during the period 22 January to 7 February, 1963.

A 3% assessment of the plant species composition, and their distribution on a 6 feet central transect on the long axis of the clear-felled strip, made during 13-14 August, 1964, is presented in Table 1. The species present on each consecutive unit length of 1 chain along the transect, from the highest to the lowest level of the strip, are given.

An experiment to investigate possible effects on the timber stand, within and beyond the area of severe debilitation which usually supported a large population of *Glycaspis* spp. and numerous other insect species, at least during the preceding 12 years, was then laid down.

The aims of these investigations were:-

(a) to determine the annual increment of tree samples in each of five plots designated by the letters A to E.

(b) To determine if clear-felling of severely debilitated areas would improve the future crop of commercial timber species.

(c) To seek evidence in the results, which could support the contention that localised site factors might be influencing the growth (? and health) of the selected trees.

(d) To observe any effects which clear-felling might have on the populations of *Glycaspis* spp. on regeneration on the area.

Five categories of trees were selected for the determination of annual increment, and the various groupings, designated as plots, together with the procedures adopted, are given below.

Plot A.—Large trees severely debilitated, and heavily attacked by *Glycaspis* spp. and other insects.

Ten large debilitated trees of *E. acmenioides* and ten of *E. paniculata*, growing beyond the clear-felled strip, were selected and tagged.

Plot B.—Large trees not attacked by *Glycaspis* spp. during the same period.

Corresponding numbers of large trees of the above two species, apparently healthy, and growing above and beyond the clear-felled strip, were selected and tagged.

TABLE 1

SPECIES	1st chn.	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th	14th	15th	Totals
Eucalyptus paniculata Sm.* (Regen.)	14	16	3	3	2	—	1	1	4	4	3	1	—	—	—	52
	26.9%	30.8%	5.8%	5.8%	3.8%		1.9%	1.9%	7.7%	7.7%	5.8%	1.9%				
Eucalyptus acmenioides Schau.† (Regen.)	3	6	—	—	—	—	7	—	2	10	4	3	6	—	—	41
	7.3%	14.6%					17.0%		4.9%	24.4%	9.9%	7.3%	14.6%			
Eucalyptus saligna Sm. (Regen.)	—	—	—	—	—	—	—	—	—	—	—	—	—	2	—	2
Eucalyptus deanei Maiden (Regen.)	—	—	—	—	—	—	—	—	—	—	2	—	—	—	—	2
Syncarpia glomulifera (Sm.) Niedenzu	—	—	—	—	2	4	8	2	5	2	—	—	8	20	5	56
					3.6%	7.1%	14.3%	3.6%	8.9%	3.6%			14.3%	35.7%	8.9%	
Angophora floribunda (Sm.) Sweet	—	—	—	—	—	—	—	—	6	4	1	4	2	10	4	31
Acacia prominens A. Cunn. ex. G. Don	5	4	1	5	7	2	1	6	6	9	7	11	7	3	2	76
Acacia elata A. Cunn. ex Benth.	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2
Acacia maidenii F. Muell.	—	3	21	—	—	—	—	—	1	1	—	—	1	—	1	28
Seringia arborescens (Ait.) Druce	13	3	8	12	11	4	—	2	19	20	—	1	2	—	2	97
Commersonia fraseri J. Gay	2	—	59	16	12	43	26	7	36	—	—	—	9	—	1	211
Rhodamnia trinervia (Sm.) Blume	—	14	15	—	—	—	10	1	—	11	7	—	—	—	17	69
Austrotricha latifolia Benth.	11	5	2	10	6	5	3	—	11	11	—	—	—	—	1	65
Helichrysum diosmifolium (Vent.) Andr.	—	—	—	—	3	—	1	1	—	4	2	—	—	1	1	13
Rubus rosifolius Sm.	4	2	—	1	—	—	2	107	43	44	6	21	9	32	7	278
Rubus moluccanus L.	—	—	—	—	1	—	—	—	—	2	—	—	—	1	—	4
Euodia micrococca F. Mueller	—	—	—	—	12	—	5	1	4	—	—	—	3	1	—	26
Casuarina torulosa Aiton	—	—	—	—	—	1	—	1	—	—	—	1	2	4	1	10
Acmena smithii? (Pdr.) Merr. & Perry	—	—	—	—	—	—	—	—	—	1	—	—	—	2	—	3
Solanum stelligerum Sm.	4	12	4	1	3	—	1	10	—	—	—	—	—	—	—	35
Polyscias sambucifolius (Sieber ex D.C.) Harms	—	—	—	—	—	—	—	—	1	—	2	—	1	—	1	5
Gahnia melanocarpa R.Br.	—	1	—	—	1	—	—	2	—	2	—	2	—	—	—	8
Notolaea longifolia Vent.	4	—	—	—	—	3	—	—	—	—	—	—	—	—	—	7
Helichrysum elatum A. Cunn. ex D.C.	—	—	—	—	—	—	—	22	2	—	—	—	—	—	—	24
Callistemon shiressii Blakely	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	2
Croton verreauxii Baill.	17	—	1	—	—	—	—	—	—	—	—	—	—	—	—	18
Persoonia linearis Andr.	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2
Goodenia ovata Sm.	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Psychotria loniceroides Sieber ex. D.C.	—	2	—	—	—	—	—	—	—	—	—	—	—	—	—	2
Cryptocarya microneura Meissn.	—	—	—	—	4	—	—	—	—	—	—	—	—	—	—	4
Clerodendrum tomentosum R.Br.	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	1
Pteridion aquilinum L.	—	—	—	—	—	2	—	—	—	—	—	—	—	—	—	2
Breynia oblongifolia J. Muell.	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	1
Backhousia myrtifolia Hook. f. & Harv.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Synoum glandulosum (Sm.) A. Juss.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Alphitonia excelsa (Fenzl) Benth.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1

* Regen. of *E. paniculata* and *E. resinifera* counted as one species.
† Regen. of *E. acmenioides* and *E. umbra* counted as one species.
NOTE:- The tallest species, and apparently of most importance on the area, as they generally assumed the role of overstorey to the *Eucalyptus* spp. regeneration, were *Acacia prominens, Seringia arborescens* and *Commersonia fraseri.* The former species appeared to offer most competition for moisture and nutriments, and provided most shade. The two latter species also appeared to offer considerable competition with the *Eucalyptus* spp.

Table 1.—3% Assessment of Plant Species and Their Distribution on the Clear-felled Strip; Number of Species on Each Consecutive Unit Length of 1 chain, From Top of Strip.

TABLE 2.

Plot A.

No.	Species	Height	DBHOB	Dominance	Crown Foliage	Epicormics on:-
1	*E. acmenioides*	40'	5.78"	Subdom.	Fair	Limbs, trunk; some limbs dead.
2	*E. paniculata*	50'	11.24"	Codom.	Poor	Limbs, trunk; some limbs dead.
3	*E. panic.*	70'	18.74"	Dom.	Fair	Limbs, trunk; some limbs dead.
4	*E. acmen.*	50'	8.78"	Codom.	Fair	Limbs only.
5	*acmen.*	40'	5.40"	Suppr.	V. Poor	Limbs, trunk; main limbs dead.
6	*acmen.*	40'	7.84"	Subdom.	Fair	Limbs, trunk.
7	*panic.*	60'	13.26"	Dom.	Poor	Limbs, trunk; some limbs dead.
8	*panic.*	30'	3.50"	Suppr.	Good	Lowest limb only.
9	*panic.*	35'	6.44"	Codom.	Poor	Limbs, trunk; some limbs dead.
10	*acmen.*	50'	6.12"	Codom.	Fair	No limbs. Numerous on trunk.
11	*acmen.*	55'	13.32"	Codom.	Good	Limbs, trunk; some limbs dead.
12	*panc.*	65'	13.46"	Codom.	Good	Limbs only; one dead limb.
13	*panic.*	55'	16.22"	Codom.	Good	Limbs only; ends of limbs dead.
14	*acmen.*	55'	11.70"	Codom.	Good	Limbs, trunk.
15	*acmen.*	55'	10.68"	Codom.	Fair	Limbs, trunk; crown all epicormics.
16	*panic.*	55'	8.24"	Subdom.	Poor	Limbs, trunk.
17	*acmen.*	50'	9.82"	Subdom.	Good	Limbs, trunk; some limbs dead.
18	*panic.*	65'	12.86"	Codom.	Fair	Limbs only; some limbs dead.
19	*panic.*	65'	12.32"	Codom.	Fair	Limbs, trunk.
20	*acmen.*	60'	10.02"	Codom.	Fair	Limbs, trunk.

Average DBHOB, 10.287"

Subdominant = tree not under spread of crown of adjacent tree.
Suppressed = tree is under spread of crown of adjacent tree.

Plot B.

No.	Species	Height	DBHOB	Dominance	Crown Foliage	Epicormics on:-
1	*panic.*	70'	20.60"	Codom.	Good	Nil.
2	*acmen.*	45'	9.80"	Suppr.	Good	Nil. Few dead twigs.
3	*acmen.*	50'	8.72"	Subdom.	Good	Few on lower limbs only.
4	*panic.*	65'	16.40"	Codom.	Good	Nil.
5	*panic.*	65'	14.96"	Codom.	Good	Nil.
6	*panic.*	30'	4.30"	Subdom.	Good	Nil.
7	*panic.*	35'	6.10"	Subdom.	Good	Lower limb only.
8	*panic.*	35'	5.98"	Subdom.	Good	Nil.
9	*panic.*	45'	7.08"	Subdom.	Good	Nil.
10	*acmen.*	25'	4.50"	Suppr.	Good	Limbs only.
11	*acmen.*	35'	6.94"	Subdom.	Good	Limbs only; few dead limbs.
12	*acmen.*	35'	8.28"	Subdom.	Good	Limbs only.
13	*acmen.*	40'	9.36"	Codom.	Good	Nil.
14	*panic.*	60'	12.10"	Codom.	Good	Nil.
15	*acmen.*	35'	6.88"	Suppr.	Good	Nil.
16	*panic.*	70'	19.20"	Dom.	Good	Nil.
17	*acmen.*	50'	15.92"	Subdom.	Good	Nil.
18	*acmen.*	50'	12.82"	Codom.	Good	Nil.
19	*acmen.*	55'	9.84"	Codom.	Good	Nil.
20	*panic.*	50'	10.50"	Codom.	Good	Nil.

Average DBHOB, 10.514"

Table 2.—Details of Large Trees on Plots A and B (August 1964).

TABLE 3

Plot C			*Plot D.*			*Plot E.*		
No.	Species	DBHOB	No.	Species	DBHOB	No.	Species	DBHOB
1	*E. panic.*	1.48"	1	*acmen.*	1.92"	1	*acmen.*	2.32"
2	*panic.*	2.38"	2	*acmen.*	2.32"	2	*acmen.*	1.16"
3	*acmen.*	1.68"	3	*acmen.*	1.20"	3	*acmen.*	2.16"
4	*acmen.*	2.44"	4	*acmen.*	1.70"	4	*acmen.*	1.44"
5	*acmen.*	1.30"	5	*acmen.*	1.58"	5	*acmen.*	1.14"
6	*panic.*	0.92"	6	*panic.*	1.42"	6	*acmen.*	1.38"
7	*panic.*	1.60"	7	*panic.*	0.62"	7	*acmen.*	1.30"
8	*acmen.*	1.50"	8	*panic.*	1.32"	8	*acmen.*	1.88"
9	*acmen.*	2.48"	9	*panic.*	0.58"	9	*panic.*	2.56"
10	*panic.*	1.54"	10	*panic.*	1.28"	10	*acmen.*	1.30"
11	*panic.*	1.84"	11	*panic.*	1.60"	11	*panic.*	0.90"
12	*panic.*	1.08"	12	*panic.*	2.24"	12	*panic.*	1.44"
13	*panic.*	2.06"	13	*acmen.*	1.50"	13	*panic.*	0.96"
14	*panic.*	2.00"	14	*panic.*	1.64"	14	*panic.*	1.52"
15	*acmen.*	1.20"	15	*acmen.*	1.86"	15	*panic.*	1.58"
16	*acmen.*	0.76"	16	*panic.*	2.32"	16	*panic.*	1.50"
17	*acmen.*	1.02"	17	*acmen.*	1.28"	17	*panic.*	1.78"
18	*acmen.*	1.80"	18	*acmen.*	1.64"	18	*panic.*	1.40"
19	*acmen.*	1.90"	19	*panic.*	1.66"	19	*panic.*	1.38"
20	*panic.*	1.32"	20	*acmen.*	1.84"	20	*acmen.*	1.00"
Average DBHOB, 1.615"			*Average DBHOB,* 1.576"			*Average DBHOB,* 1.505"		

Table 3.—DBHOB of Regeneration on Plots C, D and E (August 1964). Measurements are in Inches.

Of the total of 40 large trees utilised, all except 3 were apparently free from injury by fire or mechanical means. Aluminium labels were attached to copper wire which was inserted in the bark to the sapwood surface of each tree at about breast-height. The diameter-at-breast-height-over-bark, and general details concerning each tree, were recorded during 17 to 21 August, 1964 (see Table 2).

Plot C.—Regeneration in the clear-felled strip where trees were previously unaffected.

Ten specimens of *E. acmenioides* and ten of *E. paniculata* regeneration were selected in a length of 1 chain, across the width of 3 chains at the highest end of the clear-felled strip. As the top 1 chain of the clear-felled strip was situated beyond the general band of debilitated trees as previously described, the selected specimens were growing beyond the area of obviously debilitated trees.

Plot D.—Regeneration in the clear-felled strip where trees were previously severely affected.

Corresponding numbers of regeneration of the above two species growing near the centre of the clear-felled strip were selected.

Plot E.—Regeneration beyond the clear-felled strip but within the severely debilitated area, and more or less at the same altitude as Plot D (see Text-fig. 1).

Corresponding numbers of regeneration of the above two species were selected.

TABLE 4

Tree No.	*Plot A*	*Plot B*	*Plot C*	*Plot D*	*Plot E*
1	0.58	–0.10	1.50	1.98	0.66
2	–0.04	0.02	0.12	0.72	0.00
3	–0.04	0.10	0.46	0.78	0.64
4	0.18	0.06	1.04	1.28	0.26
5	0.18	0.22	Destroyed	1.86	0.16
6	–0.08	0.10	0.88	0.98	0.26
7	–0.04	0.20	–0.98	0.48	0.30
8	0.46	0.22	1.62	1.28	0.50
9	0.02	0.18	1.76	0.72	0.26
10	0.26	0.08	0.24	2.72	0.14
11	–0.04	0.34	0.70	1.68	0.24
12	0.04	0.46	1.80	2.62	0.56
13	–0.10	0.40	1.82	1.98	0.24
14	0.56	0.44	2.08	1.90	0.70
15	0.20	0.12	0.60	1.10	0.36
16	–0.04	0.64	0.90	1.62	0.04
17	–0.04	0.42	0.86	1.22	0.52
18	0.04	0.32	0.90	2.04	0.30
19	–0.02	0.60	0.96	1.78	0.44
20	0.38	0.20	0.74	1.52	0.20
Total Increment	2.46	5.02	18.00	30.26	6.78
Average Increment per Tree (6 years)	0.123	0.251	0.947	1.513	0.339
Average Increment per Tree per Year	0.021	0.042	0.158	0.252	0.057

Table 4.—Increments of Large Trees and Regeneration on Plots A to E (August 1970) After Six Years. Measurements are in Inches.

Sixty plants of regeneration were thus utilised for these investigations. Aluminium labels were attached loosely by copper wire loops around each specimen at about eye-level. The initial record of the DBHOB of each plant is given in Table 3. Trees in each plot were numbered 1 to 20.

During August, 1970, six years after the experiment was laid down, the DBHOB of all large trees and regeneration was recorded, and results are presented in Table 4.

DISCUSSION

General Observations, August, 1970.

Weather patterns of the period 1917 to 1957 were previously interpreted (Moore 1959, 1961b), and subsequent rainfall records of the Narara Citrus Experiment Station have shown that the annual rainfall has varied from 33.26 inches for 1957, to 87.86 inches for 1963, with an average annual precipitation on the area from 1957 to 1969, of 55.14 inches. On the basis of the previous methods of interpreting groups of wet or dry years, the years 1957 to 1969 are considered to be neither a "wet" nor a "dry" series of years, but when compared with the excessively wet series of years it is obvious that a considerable decline in rainfall occurred, and the average precipitation approached the average for the 41 years from 1917 to 1957 (see Moore 1959, pp. 192-3; 1961, pp. 197-199).

Relatively dry periods became more frequent after 1964, and the rainfall records for May to July 1970 showed the lowest rainfall for that period of 3 months since records were commenced, while only 75 points of rain were recorded for the following August, up to the 20th of that month. No rain fell during July.

Partial or complete defoliation of trees in the debilitated and insect attacked area was more or less continuous from the commencement of observations during 1953, to August 1970, but during the latter month, the debilitation (assessed on the reduced foliage, and dead trees on the area) was more pronounced than at any other time during that period. It thus appears that the trees were as severely affected, or more so, by the drier weather pattern, as by the previous wet weather pattern.

A number of debilitating factors were no doubt concerned, but it is considered that the series of interacting events discussed below appears to have been of considerable consequence in the continued poor condition of the trees in the affected area.

The excessive rainfall during the years 1949 to 1956 appears to have so severely stressed the trees, growing in a shallow top-soil and with the main root systems embedded in a deep and heavy clay subsoil, that the physiological responses of the trees were readily observable in the greatly reduced crown foliage, and the extensive epicormic growth produced on trunks and branches (see Table 2). Subsequently, during the period of drier weather (1957 to 1969), those trees with reduced functional root systems in the debilitated area were considered to be under conditions of great stress in attempting to provide sufficient moisture and/or nutriment to the trees. There was also the possibility of additional root damage by detrimental organisms to the more debilitated trees, with consequent further debilitation and deaths. Such an interpretation is supported by the results from the increment measurements recorded for Plots A and B in Table 4.

During the latter 7 years of observations, large trees growing above the clear-felled strip and towards the top of the ridge, became somewhat debilitated. This gradual spread of debilitation which moved through, and to the area above, Plot B, appears to have masked the evidence for a favourable site for Plot B, as is suggested by the trend in the figures presented in Table 4

Large Trees

Both the total increment and the average increment, over 6 years, on Plot B were more than twice that on Plot A. Nine of the twenty trees on Plot A showed loss of increment, while only one tree on Plot B showed loss of increment.

From Table 4, it could be interpreted that the large trees on Plot A, located in the debilitated area but outside of the clear-felled strip, showed low increment gains because of unfavourable site factors and consistently heavy insect attack; the large trees on Plot B, located above the debilitated area and outside of the clear-felled strip, showed greater increment gains, possibly because of more favourable site factors together with little or no insect attack. Conversely, it might also be interpreted that the degree of insect attack on these large trees was indicative of the degree of debilitation (i.e. "stress" or "site" factors) affecting them.

Regeneration

From Table 4, the total increment of regeneration on Plot D, located near the centre of the clear-felled strip, was 440% greater than that of regeneration on Plot E of approximately the same altitude, but located outside of the clear-felled strip and among debilitated large trees which had carried heavy insect attack sporadically for at least 17 years. Because of the contiguity of these two plots at about the same altitude, it was considered that possible site factors were almost identical. There is thus strong evidence that the much greater increment on Plot D resulted from the effects of clear-felling. One tree on Plot E showed no increment; all trees on Plot D showed gains in increment; and one tree on Plot C showed a loss of increment.

Psyllid populations of *Glycaspis* spp. were always in low numbers, or non-existent, on the regeneration on the clear-felled strip, while in the debilitated area contiguous to the clear-felled strip, populations of *Glycaspis* spp. continued to fluctuate from high to low numbers during the same period.

CONCLUSION

There appears to be no doubt that clear-felling of debilitated trees in insect-affected areas similar to that described above appreciably favours the regenerating timber crop by increasing the increment of eucalypt regeneration on these areas. Such increase of increment might well be indicative of the general health of the future crop, although the health of trees would probably be modified at times by discrete weather patterns throughout the growing period of the trees and more particularly during the advanced stages of their growth, in a particular area. Only continuous subsequent observations and records would more clearly define such factors.

The occurrence of large insect populations on debilitated trees in these areas is considered to be of a secondary nature, and resulting from other primary debilitating factors, principally weather, causing water stress in the trees. Similar factors in South Australia are recorded by White (1966, 1969).

ACKNOWLEDGEMENTS

The writer is grateful to the staff of The Herbarium, Royal Botanic Gardens, Sydney, who kindly identified the plant species recorded in Table 1.

Assistance provided by the Narara Citrus Experiment Station staff in making rainfall records available, is also gratefully acknowledged.

REFERENCES

Moore, K. M., 1959.—*Xyleborus truncatus* Erichson 1842 (Coleoptera: Scolytidae) Associated With Dying *Eucalyptus saligna* Smith (Sydney blue-gum). *Proc. Linn. Soc. N.S.W.*, *84*(2):186-193.

————, 1961a.—The Significance of the *Glycaspis* spp. (Hemiptera: Homoptera, Psyllidae) Associations With Their *Eucalyptus* spp. Hosts; Erection of a New Subgenus and Descriptions of Thirty-eight New Species of *Glycaspis*. *ibid.*, *86*(1):128-167.

————, 1961b.—The Biology and Occurrence of *Glycaspis baileyi* Moore in New South Wales. *ibid.*, *86*(2):185-200.

White, T. C. R., 1966.—Food and Outbreaks of Phytophagous Insects With Special Reference to *Cardiaspina densitexta* Taylor (Psyllidae, Homoptera) on *Eucalyptus fasciculosa* F. Muell. (Myrtaceae) in South Australia. Ph.D. Thesis: University of Adelaide.

————, 1969.—An Index to Measure Weather-induced Stress of Trees Associated With Outbreaks of Psyllids in Australia. *Ecology, 50*(5): 905-909.

OBSERVATIONS ON SOME AUSTRALIAN FOREST INSECTS

30. A SUPPLEMENTARY LIST OF INSECTS ATTACKING *PINUS* SPP. IN NEW SOUTH WALES

by K. M. MOORE
Forestry Commission of New South Wales

(Figure 1)

A preliminary list of insects attacking *Pinus* spp. in New South Wales was previously presented (Moore 1963a, 1963b). An additional 19 insect species now recorded have been found attacking *Pinus* spp., mainly on plantations of the Forestry Commission.

A possible predator and two parasites of insects attacking pine are recorded, and additional information on some of the species previously mentioned, is also recorded.

COLEOPTERA

BOSTRYCHIDAE

Xylobosca canina Blkb.

Host: *Pinus radiata.*
Damage: Under bark and in wood of dead branches.
Locality: Rosebank Plantation (Orange), Central Highlands, (March 1969).

SALPINGIDAE

Australosalpingus sp. near *corticalis* (Blkb.)

Host: Appears to be predatory on *Ernobius mollis* (L.).
Damage: This species appears to effect some control of *E. mollis* larvae under bark, by predation.
Locality: Glenwood Plantation (Orange), Central Highlands, (March 1969).

CURCULIONIDAE

Ethemaia sellata Pasc.

Host: *P. radiata.*
Damage: Slight damage to foliage of young plants.
Locality: Glenwood (Orange), Central Highlands (March 1969).

HEMIPTERA

FLATIDAE

Siphanta stigma Distant

Host: *P. radiata.*
Damage: Not obvious; to young foliage.
Locality: Lisarow, Central Coast (December 1961).

APHROPHORIDAE

Bathyllus moerens Stål.

Host: *P. elliottii.*
Damage: Not obvious.
Locality: Mangrove Mountain (1,000'), Central Coast.

LYGAEIDAE

Lygaeus singularis Walk.

Host: *P. radiata.*
Damage: Slight; to foliage.
Locality: Mullions Range (Orange), Central Highlands (March 1969).

MARGARODIDAE

Iceryia purchasi Maskell

Host: *P. radiata.*
Damage: Not evident; to young foliage.
Locality: Lisarow, Central Coast (March 1964).

PENTATOMIDAE

Poecilometis rufescens (Westw.)

Host: *P. radiata.*
Damage: Not evident; to foliage.
Locality: Somersby, Central Coast; Carabost Plantation (Southern Highlands); Mt. Topper Plantation (N.W. Slopes).

HYMENOPTERA

CHALCIDOIDEA

Species indet.

Host: *Ernobius mollis* attacking *P. radiata.*
Damage: Considerable control of *E. mollis* may be achieved by two chalcid species.
Locality: Woodburn Plantation, Bateman's Bay (South Coast).

LEPIDOPTERA

ARCTIIDAE

Asura habrotis Meyr.

Host: *P. radiata.*
Damage: Slight; to foliage.
Locality: Nalbaugh Plantation, Southern Highlands (February 1970).

GEOMETRIDAE

Boarmia sp.

Host: *P. radiata.*
Damage: Slight; to foliage.
Locality: Murraguldrie Plantation, Southern Highlands (November 1969).

Haploceros sphenotypa Turner
(Figure 1)

Host: *P. radiata; Bursaria spinosa; Doryphora sassafras.*
Damage: Moderate; to foliage.
Locality: Nalbaugh, Bondi, Vulcan & Jenolan Plantations, Central & Southern Highlands (February 1970).

LASIOCAMPIDAE

Digglesia australasiae (F.)

Host: *P. radiata.*
Damage: Moderate; to foliage.
Locality: Mt. Mitchell Plantation, Northern Slopes (January 1964); Jenolan Plantation, Central Highlands (February 1970).

OECOPHORIDAE

Barea banausa (Meyr.)

Host: *P. radiata.*
Damage: In rotting log.
Locality: Mullions Range Plantation, Central Highlands (March 1969).

PSYCHIDAE

Clania ignobilis Walk.

Host: *P. radiata.*
Damage: Slight; to foliage.
Locality: Mullions Range & Newnes Plantations, Central Highlands.

TORTRICIDAE

Merophyas divulsana (Walk.)

Host: *P. radiata.*
Damage: Moderate; to outer foliage.
Locality: Gurnang & Vulcan Plantations, Central Highlands (June & July 1963). Nursery plants were also attacked.

Acropolitis ergophora Meyr.

Host: *P. radiata.*
Damage: Moderate; to outer foliage.

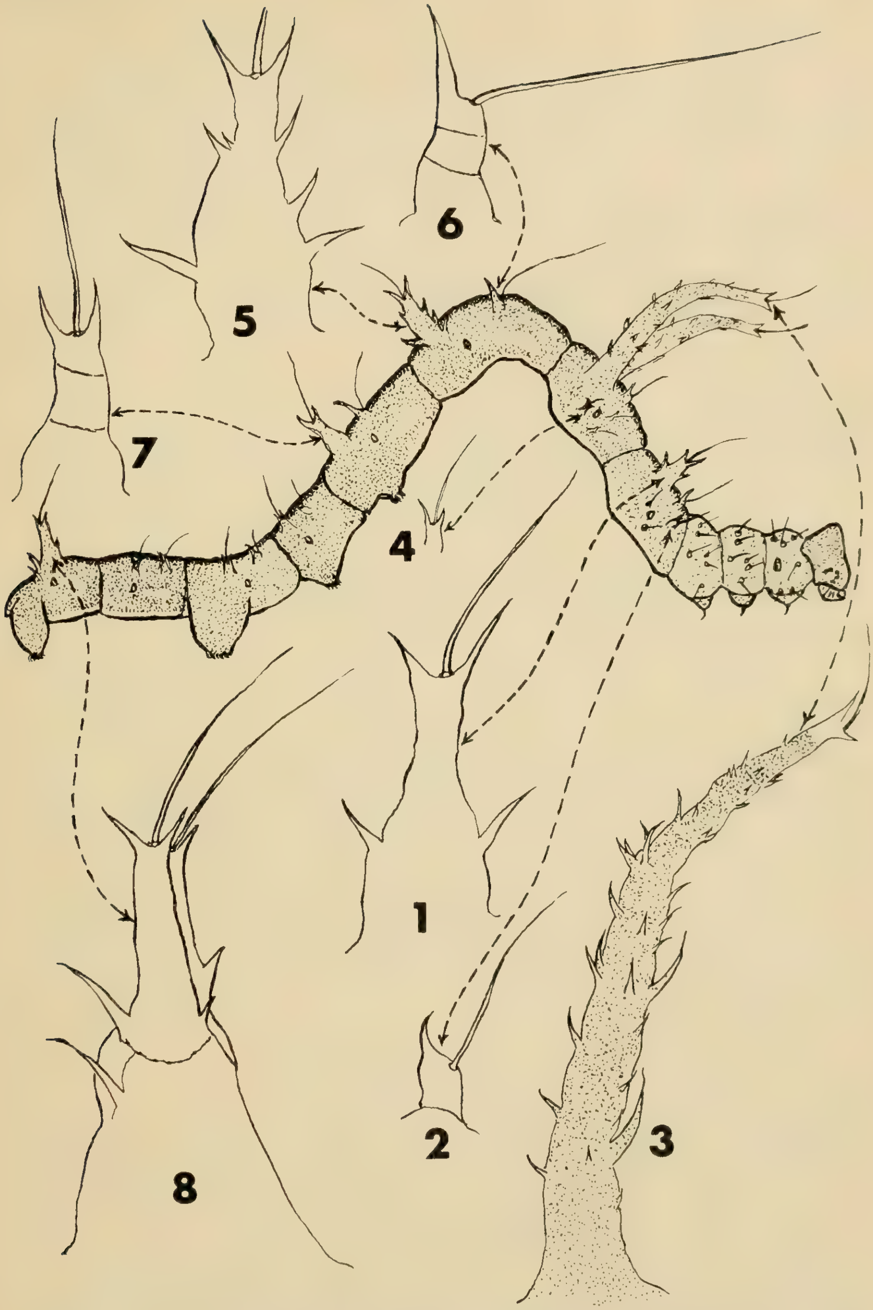


Figure 1.—Protuberances on Abdominal Segments 1 to 4 and 8 of Larva of *Haploceros sphenotypa* Turner from *Pinus radiata*. Some setae, only, are given in the figure.

Locality: Jenolan, Vulcan & Gurnang Plantations, Central Highlands (February 1970).

Epiphyas caryotis (Meyr.)

Host: *P. radiata.*
Damage: Moderate; to outer foliage.
Locality: Vulcan & Gurnang Plantations, Central Highlands (February 1970).

PHASMATODEA

PHASMATIDAE

Parasipiloidea sp.

Host: *P. radiata.*
Damage: Extensive; to one tree.
Locality: Dorrigo, Northern Highlands (March 1964).

Ctenomorpha chronus (Gray)
&
Acrophylla titan (Macl.)

Host: *P. radiata.*
Daamge: Light to moderate; to foliage.
Locality: Wyong, Central Coast (April 1970). The adult stage was reached by the former species reared on *P. radiata,* during August 1970; the other specimen was immature.

Additional information on previously recorded species is now presented:-

Ernobius mollis (L.)

It has been determined that this species also works extensively in the central pith of small twigs, when larvae are sometimes heavily parasitised by species of the Chalcidoidea.

Aoplocnemis ?guttiger Pascoe

This species occurs also at Jenolan Plantation, on *P. radiata.*

Chrysolophus spectabilis F.

Occurs also at Canobolas Plantation, and Billapaloola Plantation, Southern Highlands.

Geloptera porosa Lea

Also found at Murraguldrie Plantation, Southern Highlands.

Hylastes ater Payk.

Also taken at Mullions Range Plantation, and at Wagga (South Western Slopes).

Pineus ? laevis (Maskell) (= *P.* near *orientalis*)

It appears to the writer that this adelgid species should now be referred to as *Pineus ?laevis* (Maskell) although this is apparently not yet certain (see Eastop 1966, pp. 549-550, where it is recorded that this is the species described as *P. boerneri* from *Pinus radiata* in California, and is known from that host in Australia).

According to Eastop, *P. pini* is apparently associated with *Picea orientalis* and *Pinus* spp. of the *sylvestris* group.

Orosius argentatus (Evans)

This species also attacked regeneration of *P. radiata* 3 to 4 years old, at Bago and Carabost Plantations, Southern Highlands.

Coccus ?hesperidum L.

Also taken at Jenolan Plantation, Central Highlands.

Palaeosia fraterna (Butl.)

This species was previously given as *Palaeosia* sp.

It is now established that larvae feed on the fresh liquid sap of *P. radiata* and on fungi or lichen growing on the bark of this and other tree species. It apparently does not attack foliage.

Larval head capsules are half red and half black with the colour division horizontal.

Specimens have also been taken at Nalbaugh, Canobolas and Bago Plantations, Southern Highlands.

Clania tenuis Rosen.

Also occurs at Jenolan Plantation.

Lepidoscia ?punctiferella (Walk.)

Distribution now includes Canobolas Plantation.

Trigonocyttara clandestina Turn.

Occurs also at Nalbaugh Plantation to the Victorian border; Carabost and Bago Plantations.

Acropolitis rudisana (Walk.)

Also taken at Canobolas and Gurnang Plantations.

Epiphyas postvittana (Walk.)

Distribution now includes Mullions Range, Vulcan and Gurnang Plantations. Nursery plants are also attacked.

Epiphyas xylodes (Meyr.)

Occurs also at Green Hills Plantation, Southern Highlands.

Caedicia sp.

A different species of this genus was taken at Mullions Range Plantation.

The Recognition of *Haploceros sphenotypa* Larvae.

The larvae of all instars bear at least the prominences shown in figure 1, no. 3. The drawings are of a last instar larva.

Coloration is very variable, from deep green with white, to tan and dark brown with white. The areas of white are shown in figure 1. Length of last instar larvae, is 4 cm. to 5 cm.

Larvae of all instars were present at Jenolan, Bondi and Nalbaugh Plantations during February, 1970, and larvae of various instars are in the collection of the Forestry Commission.

Adults were reared from first to last instar larvae, on *P. radiata,* pupation occurring from early February to early April, 1970.

Digglesia australasiae.

Larvae are about 5 cm. in length, and are red-brown in colour, with a pattern of thin reddish lines forming a broad medio-dorsal stripe. A two-pointed protuberance occurs on abdominal segment 8, and there are black medio-ventral areas on most segments. Some specimens bear a series of small reddish protuberances on the dorsal and lateral aspects of most segments, and a black transverse intersegmental band posterior to both the meso- and the meta-thoracic segments.

Acyphas leucomelas (Walk.), Family Lymantriidae.

A number of white cocoons of this species occurred on foliage of *P. radiata* on the Southern Highlands. From attempted rearings of numerous larvae from eggs, it was found that the larvae apparently could not survive on that plant as host.

CONCLUSION

Eighty insect species attacking *Pinus* spp. were previously recorded, so that the present paper increases the total number to 99 species. Of that total, 93% appear to be indigenous, and 7% exotic species.

ACKNOWLEDGEMENTS

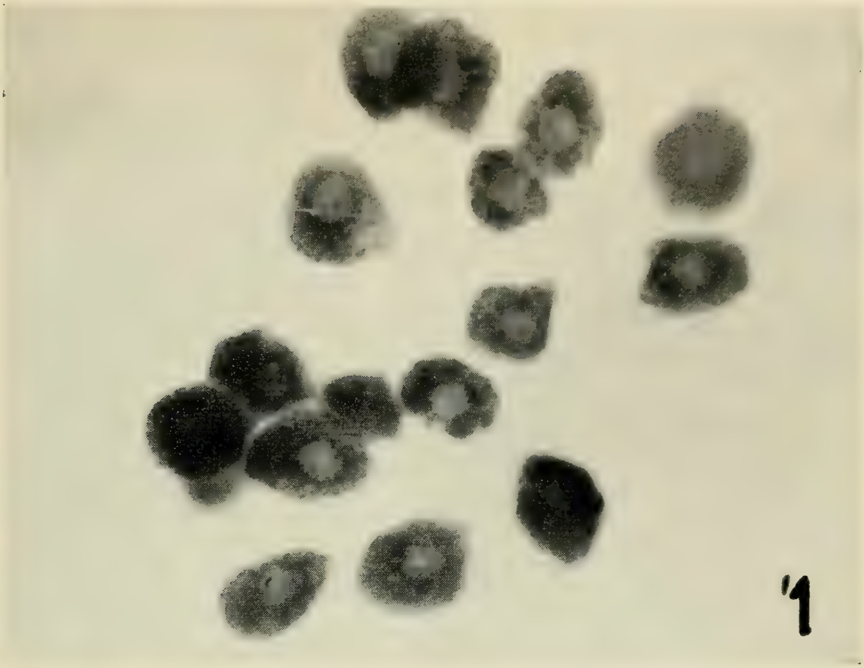
The writer is most grateful to Dr. I. F. B. Common for identifications of the Peyidoptera, and for the hosts other than *P. radiata* for *Haploceros sphenotypa;* to Dr. K. H. L. Key for identification of the phasmatids. The species of Salpingidae and Flatidae were identified by the staff of the British Museum of Natural History, London.

REFERENCES

Eastop, V. F., 1966.—A Taxonomic Study of Australian Aphidoidea (Homoptera). *Aust. J. Zool., 14*:399-592.

Moore, K. M., 1963a.—A Preliminary List of Insects Attacking *Pinus* spp. in New South Wales. *Aust. Zool., 13*(1):69-77.

————, 1963b.—Lepidoptera Attacking *Pinus* spp. in New South Wales. *Proc. Linn. Soc. N.S.W., 88*(3):340-360.



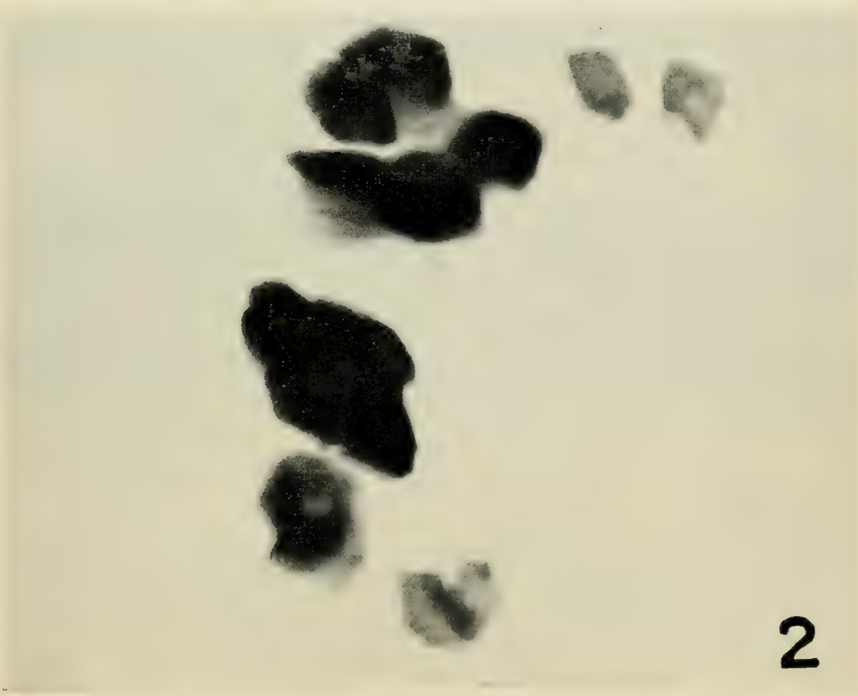


Figure 1.—Dissected pars intercerebralis of the protocerebrum of a normal individual. The 18 A-type neurosecretory cells are distinctly seen with granular neurosecretory material.

Figure 2.—Dissected pars intercerebralis of the protocerebrum of an individual starved for seven days. Note the deformity and clumping of neurosecretory granules and deeply stained neurosecretory cells.

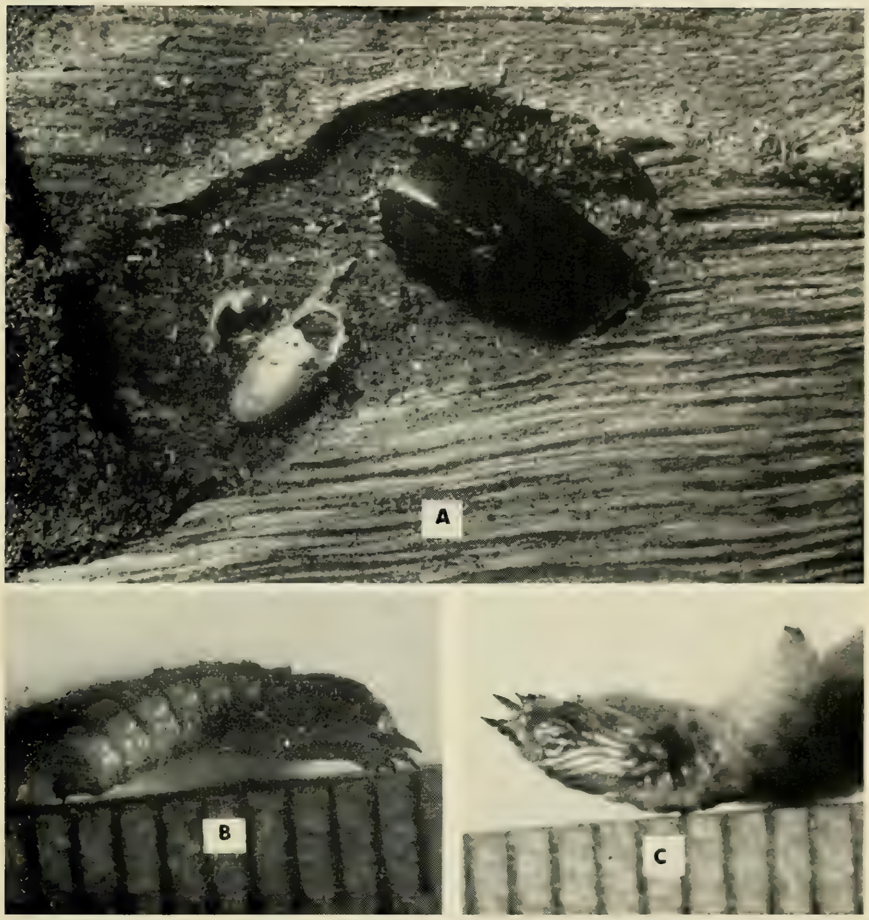


Figure A. Cocoons of *Bothrideres vittatus* Newm. and *Deretaphrus ignarus* Pasc. (COLYDIIDAE) from which adults have emerged.

Figures B. and C. Pupa of *Brachyrrhopala* sp. (ASILIDAE).

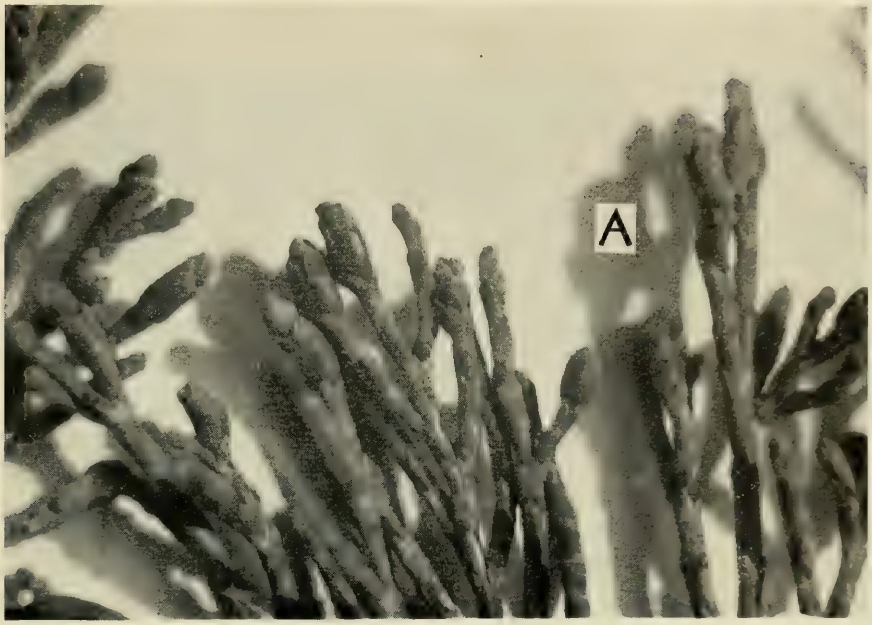


Figure A.—Galls of *Apion meridionale* (Curculionidae).

Figure B.—Galls of cecidomyiid, *"Diplosis frenelae"*.

Galls of *Apion ? pudicum* (Apionidae)

THE AUSTRALIAN ZOOLOGIST

VOL. 17 MARCH, 1972 PART 1

CONTENTS

Wholly set up and printed by

SURREY BEATTY & SONS
Rickard Road, Chipping Norton, N.S.W. 2170